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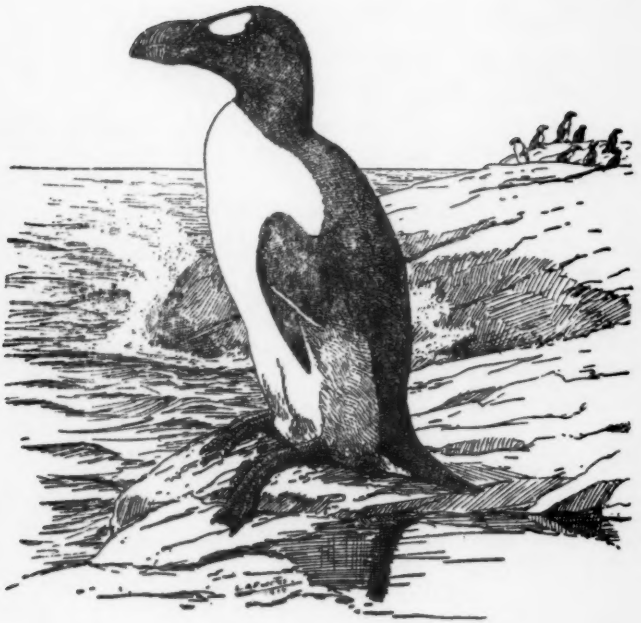

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THE DEVELOPMENT OF VISUAL DISCRIMINATION PATTERNS IN THE CROUCHING REACTIONS OF NESTLING GRACKLES*

GEORGE B. SCHALLER AND JOHN T. EMLEN, JR.

THE tendency for birds to respond consistently to specific "sign stimuli," and their ability to discriminate between these stimuli and the many other potential stimulus objects of their environment, has given rise to a theory that certain objects are "recognized" innately, *i.e.*, responded to in a specific manner without the intervention of learning processes. Such a theory can be tested only by patiently examining and experimentally analyzing the environmental conditions in which individual birds develop during the periods of sensory maturation. The present study is concerned with the basic negative response (crouching) in nestlings of the Common Grackle *(Quiscalus versicolor)*. Special attention was given to the schedule of maturation of the crouching pattern and of visual competence. Experiments were conducted with various naturalistic stimulus objects to explore the role of individual experience in the development of stereotyped, visual discrimination patterns.

STUDY AREA AND METHODS

Most of the data for this report were collected between 10 May and 15 June 1958 in a colony of 21 grackle nests located in a stand of small red cedars on the University of Wisconsin Arboretum's Picnic Point at Madison, Wisconsin. Supplementary data were obtained from other nests in the vicinity.

Nests were visited daily or twice daily during the egg stage to determine, as closely as possible, the time of hatching. Ages of young were

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recorded in hours posthatching; all age records are accurate to within six hours.

Observations of the responses of nestlings to the arrival of the parent birds were made from blinds at two nests. Tests of responses to artificial stimulus objects were made at 19 other nests. In each test a selected object was slowly raised to the edge of the nest together with a light tapping to simulate the jarring normally accompanying the arrival of the parent. The object was then gently moved about by the observer as he remained quietly hidden at arm's length, his head at the level of or slightly below the rim of the nest. Observations were discounted in all cases where the nestlings were disturbed by a clumsy approach. Test objects were selected that bore superficial resemblance to common bird species of the region; these included: (1) a stuffed male grackle, (2) a stuffed male cowbird, (3) a stuffed female cowbird, (4) a stuffed male cardinal (bright red plumage), and (5) a lifelike, brown latex model of a screech owl.

Nestlings were individually marked as necessary and records kept of the responses of each. Tests were made between 0900 and 1300 hours each day. No more than one test was made on a nest in a given day, and test objects were alternated so that no nest received the same test more often than once in three days.

These field tests were supplemented by experiments designed to interrupt the normal course of environmental experience of nestlings. These were of two types:

1. Temporary withdrawal of nestlings from the nest environment to small, isolation boxes where feeding was done by hand.
2. Temporary blindfolding of nestlings in the nest with a mask of acetate glue mixed with lampblack.

Sample specimens of nestlings were brought into the laboratory at various stages of development for measurements of visual maturation.

DEVELOPMENT OF THE CROUCHING RESPONSE

The response repertoire of a nestling grackle to the parent birds or other similarly large, stimulus objects appearing at the nest rim consists of two principal motor patterns—gaping and crouching. The former may be regarded as the basic positive response, the latter as the basic negative response.

As in many other altricial birds, the gaping response in the grackle is present at hatching. At that time and for several days afterwards it is apparently the only major response to external stimulation and is

given to a great variety of stimulus objects. Studies of the stimuli eliciting the gaping response and its orientation have been made by Holzapfel (1939), Tinbergen and Kuehnen (1939), Prechtl (1953), Messmer and Messmer (1956), and others on a variety of altricial species. The newly hatched grackles in this study gaped to such varied stimuli as touch, shake, sound, and air currents.

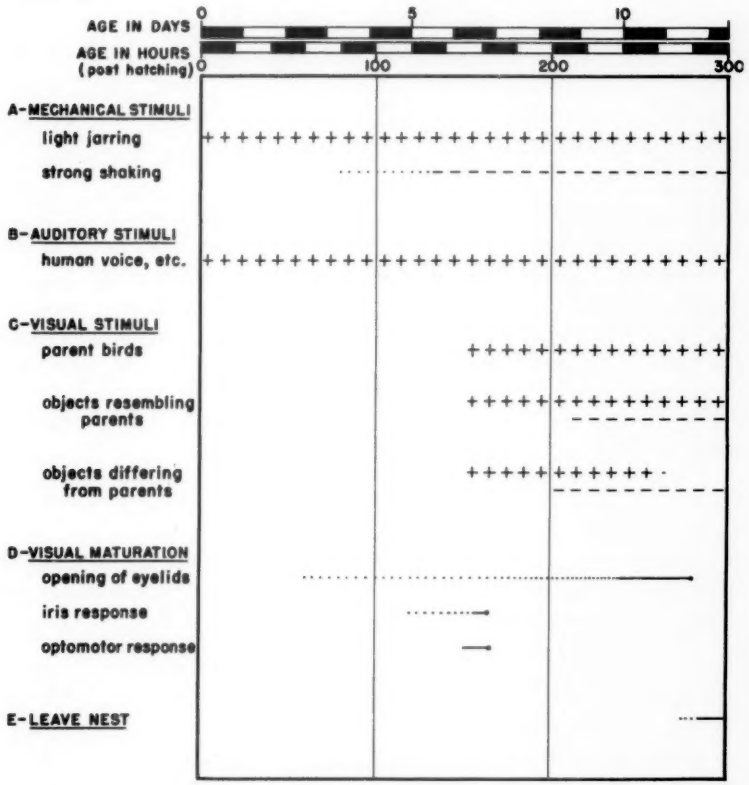

Figure 1. Time of appearance and development of crouching reactions to various stimuli and stimulus objects as related to the maturation of functional vision in nestling grackles. Plus signs (+ + +) indicate gaping responses; dashes (— — —) indicating crouching responses. Dots (. . . . .) indicate an incomplete response. In the lower part of the figure a line (———) indicates the span of variation among the tested individuals in acquiring the response. The row of dots opposite "opening of the eyelids" indicates the period during which the eyes were partially opened.

In contrast to gaping, the motor pattern of crouching did not appear in grackles until about 80 hours of age and did not fully mature until about 130 hours (Figure 1A). With strong shaking of the nest branch, newly hatched young merely rolled around in the nest cup. After about 80 hours a slight tensing was detected, and from then on the crouching response to this rather strong mechanical stimulus developed rapidly to about 130 hours. In young of more than 130 hours of age strong shaking invariably elicited intense crouching. In a full crouch the bird lowers its body into the nest cup, withdraws its head, and hunches its wings upward and forward so that they nearly cover the head. In this position it remains rigid, clutching the nest lining with its feet when the observer attempts to move it. After about 250 hours of age crouching to a disturbance was sometimes accompanied by a tense, partial opening of the mouth; and after 275 hours the birds often left the nest precipitously. Normal departure from undisturbed nests occurred between 275 and 340 hours of age.

Published accounts indicate that crouching characteristically manifests itself rather suddenly in the development of passerine nestlings. The age at which it first appears in several species as recorded in the literature is presented in Table 1. These data are not strictly intercomparable, however, since in most cases the nature of the stimulus producing the crouch is not indicated, and many workers have apparently recorded only responses to visual stimuli.

Maturation of the Visual Equipment

Crouching to visual stimulus objects does not appear, of course, until the visual equipment has become functional. The maturation of vision in nestling grackles was investigated by several methods.

The opening of the lids. The eyes of nestling grackles are closed at hatching. The lids begin to part at about 60 hours, but the cornea is still covered with a watery fluid and the nictitating membrane. The slit widens to 1½ mm. by 130 hours, to 2 mm. by 150 hours, to 3 mm. by 200 hours, and to 4 mm. (fully opened) by 300 hours (Figure 1D). Up to about 180 hours of age the eyes are opened only when gaping; thereafter the eyes remain open for increasingly longer periods to the time of fledging.

Structural development of the eye. Opening of the lids is not *prima facie* evidence of complete visual function. Portmann (1938) has shown that the structure of the eye itself in passerines is not fully developed at hatching. In the House Sparrow *(Passer domesticus)* Slonaker (1921) found that the ciliary muscles became functional at

TABLE 1

AGE OF FIRST APPEARANCE OF CROUCHING IN SEVERAL PASSERINE SPECIES

Species	*Age in days*	
Crow		
(Corvus brachyrhynchos)	18	Emlen, 1942
Blue Jay		
(Cyanocitta cristata)	14	Ivor, 1944
Black-capped Chickadee		
(Parus atricapillus)	7	Odum, 1941
American Robin		
(Turdus migratorius)	7	Kuhlman, 1909
Blackbird		
(Turdus merula)	12	Messmer and Messmer, 1956
Wood Thrush		
(Hylocichla mustelina)	9	Ivor, 1944
Catbird		
(Dumetella carolinensis)	8–9	Herrick, 1901
	6	Nice, 1943
Loggerhead Shrike		
(Lanius ludovicianus)	12	Miller, 1931
Starling		
(Sturnus vulgaris)	6–8	Kessel, 1957
Red-winged Starling		
(Onychognathus morio)	14	Rowan, 1955
Icterine Warbler		
(Hippolais icterina)	7	Heinroth and Heinroth, 1924–33
Ovenbird		
(Sciurus aurocapillus)	7	Hann, 1937
	5½	Nice, 1943
Redstart		
(Setophaga ruticilla)	9	Nice, 1943
Cowbird		
(Molothrus ater)	7	Nice, 1939
Common Grackle		
(Quiscalus versicolor)		
To mechanical stimuli	3.3–5.4	This study
To visual stimuli	8.3–9.2	This study
Rose-breasted Grosbeak		
(Pheucticus ludovicianus)	8	Ivor, 1944
Tree Sparrow		
(Spizella arborea)	7–7½	Baumgartner, 1938
White-crowned Sparrow		
(Zonotrichia leucophrys)	5	Banks, 1959
Song Sparrow		
(Melospiza melodia)	6–7	Nice, 1943

about six days. Myelinization of the optic nerve is not completed in starlings until the eighth day after hatching, according to Schifferli (1948).

The best indicators of functional vision are behavioral. Accordingly, tests were made of the pupil reflex and the optomotor response.

The pupil reflex. The pupil reflex in grackle nestlings was tested in a darkened room by holding the eyelids apart and shining a narrow beam of light from a microscope lamp into the eye. In grackles no response of the iris was noted before 120 hours. Between 120 and 150 hours slight movements were detected, but the pupil did not accommodate. Good light accommodation, presumably related to the attainment of integrated neuro-muscular control, appeared quite suddenly. In 41 tests the earliest definite response occurred at 154 hours and the latest before 163 hours (Figure 1D).

The optomotor response. Tests for optomotor responses probably provide the best available indicator of pattern discrimination. In this study the test bird was placed on a stationary platform, and a cylinder, marked with alternating, ½-inch, black and white, parallel, vertical bands, was revolved around it at a constant speed of 12 or 24 rpm. The bird was stimulated to gape and to open its eyes by lightly tapping the apparatus. A following of the moving bands by the head was interpreted as a positive optomotor response; a failure to follow was assumed to indicate lack of pattern vision. In 38 optomotor tests on grackles in the laboratory the earliest positive response occurred at 150 hours and the latest before 163 hours (Figure 1D). The acquisition of the optomotor response thus corresponds closely to the acquisition of light accommodation.

Together these data suggest that functional vision for form or pattern discrimination is attained in the Common Grackle between about 150 and 163 hours of age.

THE DEVELOPMENT OF VISUAL DISCRIMINATION

Tests with Models

In all observations responses to the principal natural stimulus object at the nest, the parent bird arriving at frequent intervals with food, were positive (gaping) and continued to be positive until the young fledged. Responses to the various test objects presented experimentally at the nest rim were also invariably positive at first and remained positive until the birds were from 200 to 220 hours of age, several days after the attainment of pattern vision (Figure 2). A change from the positive to the negative (crouching) response eventually occurred, however, to all test objects and in nearly all test birds. The shift to a negative response, once made with respect to a given test object, remained negative in all cases where test repetitions were made. The time of shifting varied with the nature of the stimulus object, occurring

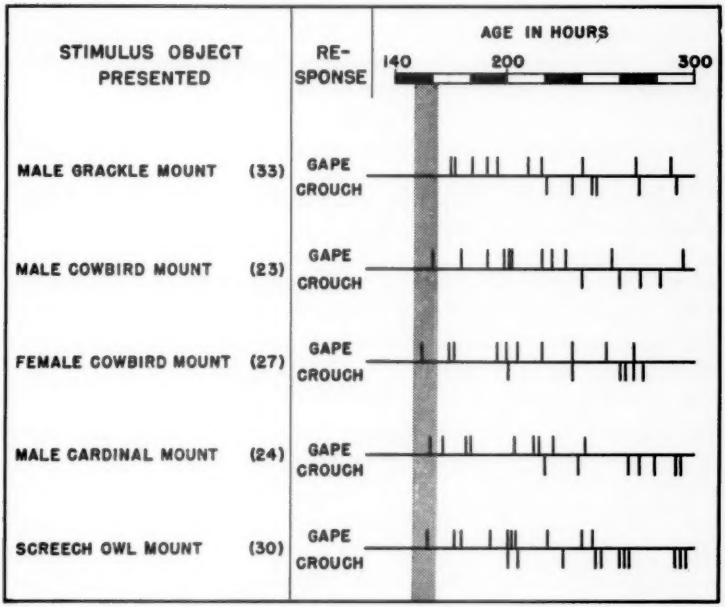

Figure 2. Record of gaping and crouching reactions of nestling grackles to various naturalistic models presented at the nest rim during the last seven days of nest life. The figures in parentheses indicate the number of tests made with each model. Nestlings were tested no more often than once per day and never more than once in three days with the same model. The shaded band designates the age (150–163 hours) at which functional pattern vision was attained. Each vertical marker represents one to four birds.

first for objects that resembled living adult grackles (stuffed grackles and cowbirds) and last for the stuffed cardinal and screech owl model.

The occurrence of crouching to the stuffed grackle mount calls for special comment, since, in theory, a perfect model of a grackle, perfectly presented, should give the same consistently positive response as that shown to the parent birds up to the time of fledging. In practice the artificial presentation departed from perfection in a number of ways. Advanced nestlings were alert to minor disturbances in the nest vicinity, and even the most cautious approach by the observer may well have been detected and served to warn the birds in advance of the test presentation. In some cases, furthermore, there was evidence that the parents regularly arrived in a particular manner at one side of the nest: devia-

tions from this norm in the artificial presentation could well influence the response. Soft calls or other warning signals may have been given by the approaching parent, although in our intimate observations from the blind at two nests we did not detect any.

Experiments with Experience Deprivation

The delay in the establishment of a negative response to the experimental stimulus objects until several days after they could be seen by the birds suggests that these objects acquired negative valence as sign stimuli only after a period of visual learning. To test this hypothesis a few simple experiments were performed, designed to deprive nestlings of the normal visual experiences of the nest environment during critical periods of development.

In one experiment 12 young grackles were withdrawn from their nests just before the attainment of pattern vision at 150 hours of age, isolated individually in small, solid-walled, open-topped boxes in the laboratory and hand fed for one or two days. They were then returned to their nests and their responses to the test models compared with those of their undisturbed nest mates.

The objective of a temporary deprivation of visual experience was, of course, not completely achieved in this crude experiment; rather, there was a substitution of an unnatural environmental situation (laboratory room with human attendant) for the natural, species characteristic situation (nest vicinity with parental attendants). The possible significance of specific features of the unnatural laboratory situation cannot be evaluated at this time.

The results are presented in Figure 3. Although the data are rather meager, it is clear that the appearance of the crouching response was delayed by this procedure by an amount roughly comparable to the period of withdrawal. The effect was strikingly apparent in comparing the responses of experimentals and controls in the same nests; the intense crouching of the normal birds to test objects in no way influenced the uninhibited gaping of their experimentally retarded nest mates.

In the second experiment seven nestlings were blindfolded with a preparation of glue and lampblack, a procedure well tested in our laboratory on various other animals of comparable size. Blindfolded birds continued to gape to all mechanical stimuli at the nests. They were well fed and suffered no apparent injury or disturbance other than that of visual deprivation.

Three birds kept blindfolded from about 60 to about 150 hours of

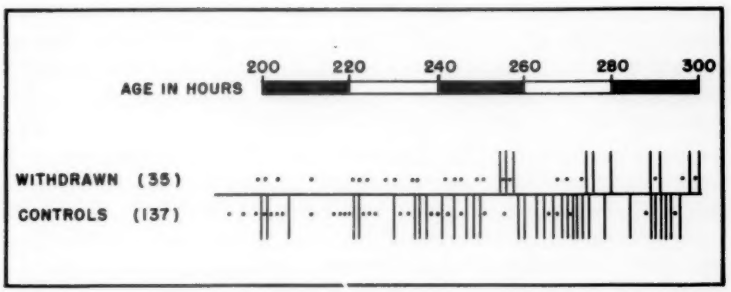

Figure 3. The effect of an experimental interruption of normal nest experience (temporary removal from the nest) on the time of appearance of crouching reactions to models in young grackles. Gaping reactions are indicated by dots, crouching reactions by bars.

age showed no delay in the appearance of the crouching response to strong jarring of the nest or, after removal of the blindfold, in the development of visual discrimination to test objects. Another bird, blindfolded from 150 to 275 hours of age, showed complete and normal optomotor response when tested upon removal of the blindfold. The experimental procedure thus had no detectable effect on the maturation of the basic response equipment.

Three nestlings blindfolded from 150 hours to 267–295 hours of age gaped strongly and unhesitatingly to the screech owl model upon removal of the mask, while their untreated nest mates (controls), in striking contrast, crouched tensely on the nest floor. This gaping response to the owl persisted even when these experimental birds were removed from the nest and held in the hand. Discrimination developed rapidly, however, and two of these birds crouched to the owl model within 24 hours; the third continued to gape to the test models until it fledged the next day.

These deprivation experiments, while crude in several respects, suggest that the visual experience ordinarily obtained by nestling grackles in the natural nest environment may be necessary for the normal development of discrimination between parent birds and other stimulus objects that may appear at the nest rim.

Discussion

The ability to distinguish natural enemies as specific stimulus objects for avoidance responses has been examined in various altricial birds by Nice and ter Pelkwyk (1941), Rand (1941), Kramer

and St. Paul (1951), Hinde (1954), and others; and attention has been called to a well-defined ability by some species to discriminate between potentially injurious and harmless forms. Little attention, however, has been given to the early ontogeny of these discriminations and to the relative role of learned and unlearned contributions to their development. Crouching in the nest is a rather specialized form of avoidance behavior with a limited functional duration in the life of the bird. It does, however, bridge the important stage of development during which the motor and sensory mechanisms of avoidance are maturing, and displays in its later phases some clear evidence of object discrimination. Crouching, furthermore, possesses the essential elements of motivation, stereotypy, and adaptiveness that characterize behavior patterns commonly referred to as instinctive.

The observations and experiments described in this report indicate that individual experience played an important role in the development of early visual discriminations shown by nestling grackles in their crouching responses. They suggest, furthermore, that the visual stimulus situations of the natural nest environment, and particularly those associated with the parent birds in their frequent visits with food, could provide the basis for development of the characteristic discrimination patterns displayed by advanced nesting grackles in nature.

Two alternate explanations can be offered for the inhibitory effects of experience deprivation shown by our withdrawn and blindfolded birds: (1) a delay in the development of an ability or readiness to respond to specific sign stimuli of innately determined releasing significance or (2) an interference with the process of discrimination learning by blocking the input of sensory information.

The first of these explanations cannot be properly evaluated at this time, since we do not yet have adequate data on the specificity of the stimulus object necessary to release the initial, visually determined, crouching responses. Knowing the ease with which nestlings of several other species will accept foster parents, however, we tend to doubt that the implied specificity exists.

We therefore favor the second explanation and the view that the crouching (avoidance) response of our grackle nestlings to certain visual stimulus objects was acquired only after several days of experience with pattern vision had provided a basis for distinguishing the consistently rewarding stimulus object (the parent) from other (strange) objects. Thereafter, with a basis for recognizing strangeness in terms of lack of familiarity, the response to new objects as they were encountered tended to be negative until their positive or neutral nature had been established through experience.

This interpretation of our data on grackles differs from that of traditional instinct theory in attributing the delay in visual avoidance responses to the insertion of a learning period in which the bird acquires a basis for distinguishing visually between rewarding and nonrewarding stimulus objects. More work is obviously needed to clarify the significance of the first consistently rewarding stimulus object (the parent) in its functional relation with other objects on their first presentation. According to our interpretation, however, new or strange objects are responded to negatively only because they differ essentially from the one (or several) that have come to be accepted. All objects seem to be accepted (gaped to) by the nestling grackle until after the initial, visual learning period in which the basis for familiarity is established; thereafter, all new or strange (unfamiliar) objects elicit a negative response. Many authors (Nice, 1943; Kramer and von St. Paul, 1951) have noted the role of familiarity and strangeness in determining avian responses; the view here presented merely adds the concept that strangeness is relative and exists only in opposition to familiarity, a characteristic that must be acquired through experience. This theory shares elements with that of Hebb (1946) in which fear (the motivational basis for avoidance behavior) is regarded as arising from the disruption of established behavior (neural) patterns.

The uniformly consistent positive response of advanced nestling birds to the parent on the one hand, and the equally consistent negative response to a strange and potentially dangerous object, such as an owl, on the other, suggests a basic discrimination that one is tempted to regard as innate. The data obtained in this study, however, support a learned basis for the phenomenon in the Common Grackle. The interpretation proposed recognizes a very general basis for avoidance response based on familiarity and strangeness as derived and elaborated in individual birds through experience. It is proposed that the stereotypy and specificity of the stimulus selection patterns characteristic of advanced nestling birds may well be due to the basic stereotypy and specificity of the nest environment rather than to similarities of genetic constitution.

ACKNOWLEDGMENTS

We are grateful to Mr. John L. Kaspar for help in collecting field data; to Dr. K. S. Rawson for technical advice; and to Drs. N. Tinbergen, F. Sauer, and N. E. Collias for suggestions on the manuscript.

SUMMARY

Nestlings of the Common Grackle in 21 nests at Madison, Wisconsin,

showed crouching (responses) to mechanical stimuli well before the maturation of pattern vision, but did not crouch to visual stimuli until two or three days after pattern vision has been acquired.

Experimental withdrawal of nestlings from their nests for one or two days produced a comparable delay in the acquisition of crouching responses to visual models.

Temporary blindfolding of nestlings did not affect the maturation of crouching to mechanical stimuli or of the optomotor response to moving patterns. When extended into the visual discrimination period (after maturation of the optomotor response), however, it did postpone the onset of crouching to visual models.

It is proposed that in grackle nestlings crouching responses are given to visual stimuli only after a period of visual learning has provided a basis for discriminating between the consistently rewarding parent and other objects.

LITERATURE CITED

BANKS, R. C. 1959. Development of nestling White-crowned Sparrows in central coastal California. Condor, **61**: 95–109.

BAUMGARTNER, A. M. 1938. A study of development of young Tree Sparrows at Churchill, Manitoba. Bird-Banding, **9**: 69–79.

EMLEN, J. T. 1942. Notes on a nesting colony of western crows. Bird-Banding, **13** (4): 143–154.

HANN, H. W. 1937. Life history of the Ovenbird in southern Michigan. Wilson Bull., **49**: 145–237.

HEBB, D. O. 1946. On the nature of fear. Psychol. Rev., **53**: 259–276.

HEINROTH, O., and M. HEINROTH. 1924–1933. Die Vögel Mitteleuropas. 3 vols. Berlin.

HERRICK, F. H. 1901. The home life of wild birds. Knickerbocker Press, New York. xix + 148 pp.

HINDE, R. A. 1954. Factors governing the changes in strength of a partially inborn response as shown by the mobbing behavior of the Chaffinch (*Fringilla coelebs*). Proc. Roy. Soc. **B142**: 306–358.

HOLZAPFEL, M. 1939. Analyze des Sperrens und Pickens in der Entwicklung des Stars. Jour. f. Ornith., **87**: 525–553.

IVOR, H. R. 1944. Bird's fear of man. Auk, **61**: 203–211.

KESSEL, B. 1957. A study of the breeding biology of the European Starling (*Sturnus vulgaris* L.) in North America. Am. Midland Nat., **58** (2): 257–331.

KRAMER, G., and U. VON ST. PAUL. 1951. Über angeborenes und erworbenes Feinderkennen beim Gimpel (*Pyrrhula pyrrhula* L.). Behaviour, **3** (4): 243–255.

KUHLMAN, F. 1909. Some preliminary observations on the development of instincts and habits in young birds. Psych. Rev. (Monogr. Suppl.), **11**: 49–85.

MESSMER, E., and I. MESSMER. 1956. Die Entwicklung der Lautäusserungen und einiger Verhaltensweisen der Amsel (*Turdus merula merula* L.) unter natür-

lichen Bedingungen und nach Einzelaufzucht in schalldichten Räumen. Zeitsch. f. Tierpsych., **13** (3): 341–439.

MILLER, A. H. 1931. Systematic revision and natural history of the American shrikes (*Lanius*). Univ. Cal. Publ. Zool., **38**: 11–242.

NICE, M. M. 1939. Observations on the behavior of a young cowbird. Wilson Bull., **51**: 233–239.

NICE, M. M. 1943. Studies in the life history of the Song Sparrow. II. Trans. Linn. Soc. N.Y., **6**: 1–328.

NICE, M. M., and J. J. TER PELKWYK. 1941. Enemy recognition by the Song Sparrow. Auk, **58**: 195–214.

ODUM, E. P. 1941. Annual cycle of the Black-capped Chickadee. Auk, **58**: 518–535.

PRECHTL, H. F. R. 1953. Zur Physiologie der angeborenen auslösenden Mechanismen. I. Quantitative Untersuchungen über die Sperrbewegung junger Singvögel. Behaviour, **1**: 32–50.

PORTMANN, A. 1938. Beiträge zur Kenntnis der postembryonalen Entwicklung der Vögel. Rev. Suisse de Zool., **45**: 273–348.

RAND, A. L. 1941. Development and enemy recognition of the Curve-billed Thrasher: *Toxostoma curvirostre*. Bull. Am. Mus. Nat. Hist., **78**: 213–242, **79**: 517–524.

ROWAN, M. K. 1955. The breeding biology and behaviour of the Red-winged Starling, *Onychognathus morio*. Ibis, **97**: 663–705.

SLONAKER, J. R. 1921. The development of the eye and its accessory parts in the English Sparrow. Jour. Morph., **35**: 263–357.

SCHIFFERLI, A. 1948. Über Markscheidenbildung im Gehirn von Huhn und Star. Rev. Suisse de Zool., **55**: 117–212.

THORPE, W. H. 1956. Learning and instinct in animals. London, Methuen and Co., viii + 492 pp.

TINBERGEN, N., and D. J. KUEHNEN. 1939. Über die auslösenden und richtungsgebenden Reizsituationen der Sperrbewegung von jungen Drosseln (*Turdus m. merula* L. und *Turdus e. ericetorum* Turton). Zeitsch. f. Tierpsych., **3**: 37–60.

TINBERGEN, N. 1948. Social releasers and the experimental method required for their study. Wilson Bull., **60**: 6–51.

University of Wisconsin, Madison, Wisconsin.

AN ANCIENT PUEBLO TURKEY

A. W. Schorger

The anatomy and color of the plumage of the domestic turkey has undergone considerable change from those of its wild ancestors. The turkey in the Southwest was domesticated at least as early as the Pueblo I period (c. 700–900 A.D.), and was held in captivity, possibly domesticated, during the Modified Basketmaker Period (c. 500–700 A.D.; Martin *et al.*, 1947: 528). It was of interest to determine if the bird kept by the Pueblos had undergone any change. The bones found at archaeological sites have shown no definite difference from those of the wild bird *(Meleagris gallopavo merriami)*. The best approach to the problem appeared to be an examination of desiccated turkeys that retained some of their plumage. In 1905 Hough (1914: 139) made a cursory examination of Tularosa Cave, which is located a short distance northeast of Reserve, New Mexico. A photograph in his paper showed a turkey that appeared to retain many of its feathers. Fortunately the specimen was still in the U.S. National Museum and was forwarded to me by Herbert Friedmann, to whom I wish to express my thanks. A photograph of the turkey in its present condition is shown in Figure 1.

Only the shafts for the most part of the primaries and secondaries remain, and there are feathers on various parts of the body. The rectrices are missing and may have been plucked. There are numerous pin feathers on the shoulders. Under normal conditions this would indicate that the bird was in molt and that it died in July or August; however, the presence of all of the shafts of the primaries shows that molt was not in progress. The Pueblos plucked their turkeys to obtain feathers for ceremonial purposes and for the manufacture of feather blankets, so that the pin feathers may result from plucking rather than molt. Hough's photograph indicated that the neck was feathered (Figure 2). This seemed so improbable that I concluded that the effect might be due to a shadow. Surprisingly the neck proved to be densely feathered to the base of the skull, a condition unique among turkeys. The shape of the neck feathers (Figure 3) differs decidedly from that of the normal neck feather (Figure 4) of a Merriam's Turkey taken from the same position on the neck. The shaft ends so abruptly that there was a possibility that a filoplume had broken off. None of the neck feathers show a filoplume extension, and under the microscope there is no indication of a fractured end. The neck feathers are semiplumes and more downy than the semiplumes to be found on the neck

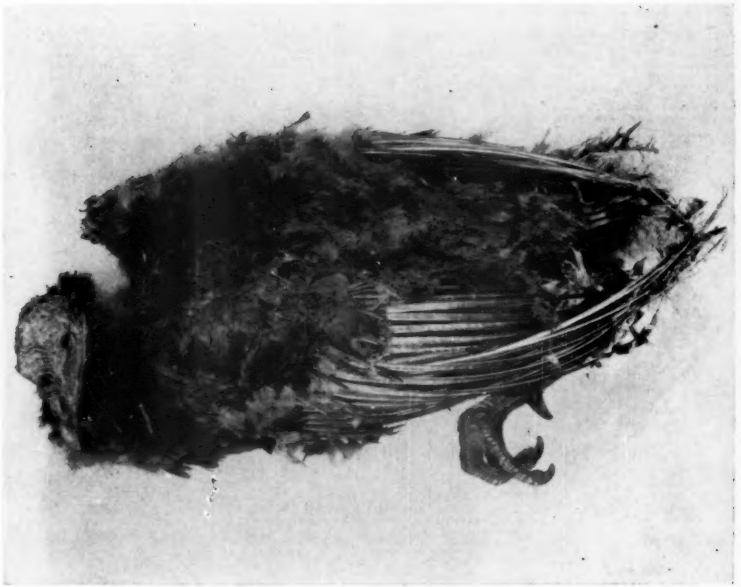

Figure 1. The Tularosa Turkey in its present condition.

of subadult wild turkeys. The nodes on the barbules of the latter feathers are less developed than on those of the Tularosa specimen.

The Tularosa Turkey, except for the neck, was not safely distinguishable from Merriam's Turkey. The bird, a male, was at least three years of age, judging from the spurs, which were 27 mm. in length and 16 mm. wide. The present domestic turkey is characterized by a great increase in the diameter of the tarsus. The width of the tarsus of the Tularosa Turkey, measuring from front to rear just above the spur, was 17 mm. That of the tarsus of an extra leg of a male found with this bird was 16 mm. These measurements are not abnormal. The tarsi measured 144 mm. in length and that of the extra leg 150 mm. These tarsi are distinctly shorter than those of the wild bird. Ridgway (Ridgway and Friedmann, 1946: 452) gives for the male Merriam's Turkey 159–175 (166.6) mm. The color of the tarsi of the Tularosa Turkey was dragon's blood red, and that of the extra leg was xanthine orange. The bill was mainly grenadine in color with spots of grenadine red. The tip was horn colored. All the pre-Columbian tarsi that I have seen had some shade of red. I do not believe that the "captive" bird of the Pueblos was far removed from the wild one. It

Figure 2. Thickly feathered neck.

is probable that the stock was increased from time to time by wild birds and their eggs. At Taos Pueblo I was told by an old Indian that the only turkeys raised by them were wild poults captured in the mountains and then held in confinement. One turkey, about a year old, seen in a pen, had no tail, but the "rump" was like that of Merriam's Turkey. By no means all of the turkeys came directly from the wild birds. I have seen a downy poult in perfect condition found at Cliff House, Mesa Verde. Archaeologists have unearthed egg shells, and found artificial nests made of adobe containing turkey feathers and fragments of shells.

The literature is void of definite information on what the captive

Figure 3. Feather from the neck of the Tularosa Turkey X5.

turkeys ate, and whether they were allowed to forage or were kept confined. It is known that practically every pueblo had its turkey pen and that in the cliff dwellings the pen was located in the rear of the cave. It is believed at Mesa Verde that the turkeys ranged most of the year, and three dioramas there show turkeys at large. Several of the early Spanish accounts mention turkeys in pens, but none of which I am aware speaks of them as running loose. Most of the pueblos were so situated that I doubt if even a Pueblo would have indulged in the labor of getting the turkeys up and down daily.

Clinging to the breast of the Tularosa Turkey was some dry dung in its original form. Some of this material was placed in water, triturated, and allowed to settle. The supernatant liquid was wine colored, and I concluded that the color was due to the water-soluble, anthocyanin coloring matter found in certain types of "squaw" corn. Some of the dung was taken to Professor Hubert B. Cooper, Jr., to check for the presence of remains of corn. None were found, but perfect granules of starch from some species of legume were present

Figure 4. Normal feather from the neck of Merriam's Turkey X4.

in quantity. I then wrote to the Gila National Forest at Reserve regarding the presence of wild legumes. Norman F. Mathews informed me that there were no legumes growing within many miles of Tularosa Cave and that it lies strictly within the Pinyon-Juniper woodland type. In addition to corn the Pueblos raised beans similar to kidney beans. It is quite clear that the turkeys were also fed beans and that the Tularosa Turkey chanced to die on some dung deposited at a time when beans were being fed.

An incision was then made in the skin covering the crop, the tissue of which had disappeared. On tapping the turkey on the back, 190 cc. of corn kernels were obtained. These kernels were of colored flint corn and perfect in shape, though for the most part hollowed by insects (Figure 5). Attempts to germinate some of the whole kernels were unsuccessful. On 21 June 1960 I collected some dung at the turkey pen at Balcony House, Mesa Verde. This pen is not in the main cave but in a shallow one about 300 feet from it. This dung was also examined by Professor Cooper. He detected the presence of the pericarp and starch of corn, and the integument and starch of a legume. It is remarkable that the starch granules survived the digestive processes and a thousand years of exposure. The Tularosa Turkey did not die of disease, since a sick bird will not eat. It is my opinion that the cave was abandoned suddenly and that the turkey died of thirst.

The age of the turkey cannot be determined with any degree of exactness. At the time that Hough was digging, little attention was paid to stratigraphy. The houses were filled nearly to the roof with debris. Some of the kernels of corn were sent to Dr. Hugh Cutler, Missouri Botanical Garden, who has done much work on ancient corn.

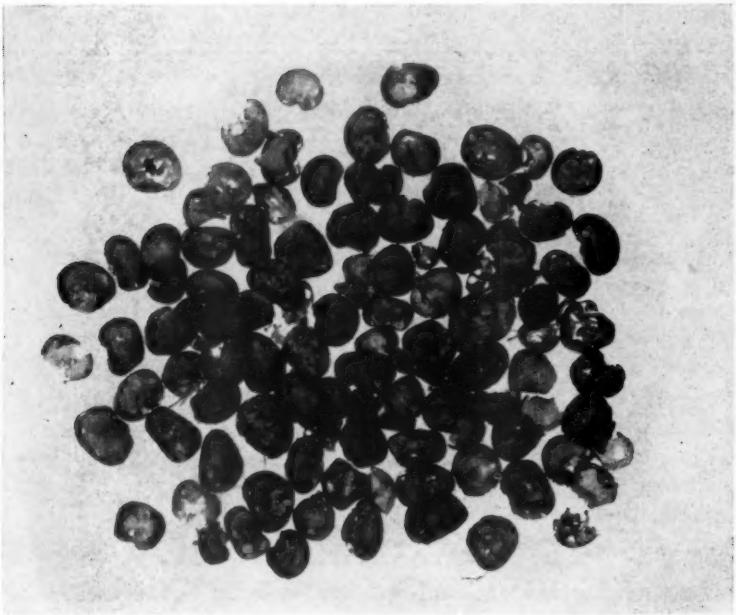

Figure 5. Corn from the crop of the Tularosa Turkey.

He measured the angles of the grains and informed me that corn of this type was grown as early as the middle of the Georgetown Phase (500–700 A.D.). Tularosa Cave has been thoroughly explored by Martin *et al.* (1952: 528). He concluded that it was occupied more or less continuously from 300 B.C. to 1100 A.D., and that turkeys appeared in the Pinelawn Phase (150–500 A.D.). It seems conservative therefore to give the age of this turkey at 1,000 years. Under date of 25 April 1960 Paul S. Martin wrote to me: "I think you would be perfectly safe in saying that the turkey dates back to 1100 A.D. and perhaps earlier. We found a couple of turkeys that dated from about the beginning of the Christian era and they were in fine condition." Unfortunately, these specimens were subsequently destroyed.

It is difficult to determine if the Tularosa Turkey is a mutant, a subspecies, or a new species. Attempts to locate a comparable specimen have been unsuccessful, and until this is done no decision will be made. There is a well-feathered turkey from Canyon du Chelly, Arizona, in the museum at Mesa Verde. It is in a glass case and could not be

examined closely. The head is missing, and of the neck only a few cervical vertebrae remain.

I wish to express my appreciation for the many courtesies extended by Jean Pinkley, Archaeologist, while at Mesa Verde.

LITERATURE CITED

HOUGH, W. 1914. Culture of the ancient Pueblos of the Upper Gila River region, New Mexico and Arizona. U.S. Nat. Mus. Bull. 87. 139 pp.

MARTIN, P. S., G. I. QUIMBY, and D. COLLIER. 1947. Indians before Columbus; twenty thousand years of North American history revealed by archeology. University of Chicago Press, Chicago. 582 pp.

MARTIN, P. S., J. B. RINALDO, E. BLUHM, H. C. CUTLER, and R. GRANGE, JR. 1952. Mogollon cultural continuity and change; the stratigraphic analysis of Tularosa and Cordova Caves. Chicago Natural History Museum, Fieldiana, Anthropology, 40. 528 pp.

RIDGWAY, R. and H. FRIEDMANN. 1946. The birds of North and Middle America. U.S. Nat. Mus. Bull. 50, Pt. x. 484 pp.

College of Agriculture, University of Wisconsin, Madison 6, Wisconsin.

A NESTING OF THE LEAST FLYCATCHER

MARGARET M. NICE AND NICHOLAS E. COLLIAS

IN 1954 we found a nest of *Empidonax minimus* at Delta, Manitoba, conveniently situated for observation. Although both of us were primarily engaged in studies on precocial birds, this discovery seemed to us an excellent opportunity to become better acquainted with the habits of these engaging little birds.

At that time little had been published on the nesting behavior of this species. Saunders (1938) had reported on 13½ hours of watching by his students at a nest in Allegany State Park, New York. De Kiriline (1948) had given a general picture of the nesting behavior of eight pairs, only one of which raised its brood, at Pimisi Bay, Ontario. MacQueen (1950) had studied a "colony" of these birds for three summers at Douglas Lake, Michigan; she found 44 nests, but her paper deals almost entirely with territory and song, with a brief summary of the events of the nesting cycle.

In 1959, however, Davis published an important paper on a "colony" of Least Flycatchers studied by him and his students at Mountain Lake, Virginia from 13 June to 18 July 1956. Besides treating territorial behavior and voice, he summarizes the results of 36 hours' observation of rhythm of incubation in a number of nests and 103 hours' observation of the care of the young in seven nests; these hours were well distributed throughout the day from 0430 to 2000. He also kindly gave me further details on those nests watched while holding young.

Our nest was discovered on 23 June 1954, 1.5 meters up in an alder next to the library of the Delta Waterfowl Research Station. This pair had no near neighbors of the same species, so there was no opportunity to observe territorial behavior. Four eggs were laid from 27 to 30 June; steady incubation was in progress by the 29th. One nestling hatched between 0900 and 1100 on 13 July; at 2000 the nest still held one chick and three eggs. At 0800 the next morning there were two nestlings and one egg; this egg never hatched. As the eggs were not marked, the length of incubation in this nest is uncertain. De Kiriline reports it as 15 days; MacQueen as 15 to 16. The young left on 27 July at 13 and 14 days of age.

A burlap blind was constructed by Collias so that the nest could be watched from a distance of about 1 meter. He observed the nest for two hours on 28 June, and he and Elsie C. Collias watched it for four hours from 14 to 18 July. My daughter Constance and I watched the nest every day for one to three hours from 14 to 27 July, a total of

20 hours. Eleven of the 24 hours spent by all of us at the nest in July were in the morning and 13 in the afternoon, the latest ending at 1742. The parents were distinguishable by appearance as well as by behavior and voice; only the female had an eye ring, and, furthermore, was lighter in color than was her mate.

VOICE

All of us recorded soft *tsips* and *whits* from both parents, as well as twitters and chatters, and also a gentle and melodious trill lasting one or two seconds and barely audible from the blind. All these notes seemed to be greetings to the mate or young. Collias experimented with a nestling the day after it hatched; it responded to a low, soft whistle by promptly gaping, but paid no attention to a clucking sound. This experiment was repeated 10 times and gave identical results. Both parents often gave a sharp, explosive *quit* when alarmed by human beings or other potential enemies.

The daytime song of the Least Flycatcher is the well-known *che-bec*, which Davis considers the "male position note." Our bird gave it often when approaching and leaving the nest.

The twilight song of the Least Flycatcher received special attention from MacQueen; she describes it as a rhythmic, continual series of *che-bec*s uttered about 60 times a minute. Winsor M. Tyler (Bent, 1942: 222) counted 60 and 75 songs per minute from a bird that started singing at 0318 on 18 June 1912. MacQueen (1950: 201) gives a very interesting table showing the beginning and ending of the twilight song in the Least Flycatchers for 10 mornings from 29 June to 2 August 1946, as well as times of civil twilight and sunrise. On five days she adds the beginning and end of the Eastern Kingbird's (*Tyrannus tyrannus*) twilight song. On 29 June 15 Least Flycatchers were singing, by 18 July their number had decreased to 10, by 22 July to 4, and on 1 August to 1. On 18 July the kingbird began 60 minutes before sunrise and sang for 30 minutes; the flycatchers began 30 minutes before sunrise and sang for 25 minutes.

Unfortunately, we did not watch for this song from our bird until 18 July. I started to listen at 0330; at 0401 there was a single *che-bec* and that was all from our flycatcher. An Eastern Kingbird gave his twilight song from 0402 to 0414. I watched the sunrise at 0420. Our bird evidently had given up his twilight song. MacQueen noted that "Many males singing in adjoining territories seem to stimulate one another." Such stimulus was lacking for our bird. Davis (1959:

77–78) describes the varying amounts of singing of 13 males, but gives few details on the twilight song.

EGG LAYING

On 28 June Collias watched the nest from 0510–0710. The female laid her second egg between 0525 and 0540, pressing down her tail and pumping it slightly; she raised her rump feathers and once seemed to "strain" forward. She returned to the nest five times before 0710. Once the male fed her. The next morning she was incubating steadily. She alone incubated, as has proved true in all species of the Tyrannidae that have been carefully studied (see Skutch, 1960: 575).

CARE OF THE YOUNG

After the second young hatched, the nest was watched each day for one to four hours until the young birds left. Only the female brooded. During the first four days she brooded from 70 to 80 per cent of the time watched, on the next two days 65 per cent of the time. After that there was no brooding, but some shading by the female from the seventh to the 11th day. Davis reports much the same amount of brooding for the first five days—from 72.9 to 77.3 per cent. The sessions on and off the nest of our bird were usually short; 68 of the former during the first week lasted from 1 to 35 minutes, the median being four minutes; 63 of the latter during the same period lasted from 1 to 10 minutes, the median being three minutes.

Very small insects were brought, apparently no more than one at a time. The rate of feeding increased from an average of 5.7 per hour during the first five days to 8.4 during the next five days to 12 during the last three days. Like Davis, we found that the rate of feeding "more than doubles from early to late nestling stages." The highest hourly rate of feeding was 13, recorded both on days 8 and 12.

In 23 hours of observation with two young in the nest, the male brought 92 meals and his mate 70, a total of 162, an average of seven per brood per hour. Interestingly enough, this corresponds closely with Davis' results of 25.5 hours throughout nest life on a brood of two—namely 7.2 times. In two nests with three young watched for 15 hours, and three nests with four young watched for 62 hours, the average for the 77 hours was almost double—14.2 per hour.

The rate of feeding per bird throughout nest life was 3.5 times an hour for both Davis' and our birds. This corresponds well with the median of 3.7 meals per young for 14 broods of 10 species of passerines

in Table XXV in my monograph (1943: 235) on the behavior of the Song Sparrow.

De Kiriline observed feeding rates of four young Least Flycatchers of 6.4 times per hour early in nest life and 24 times per hour for three hours when the young were 12 days old. The female brought two-thirds of the meals. At Saunders' nest with two young only the female was present; she fed from 7–37 times an hour, averaging 24 times in 13½ hours. An amazingly high figure from MacQueen's manuscript is given by Kendeigh (1952: 239), namely an *average* of 33.8 meals per hour for three nestlings from 2–13 days of age, the male parent making two-thirds of the trips. Most of the observations must have come late in nest life.

As to sanitation at our nest, the male was seen to swallow 15 excreta during the first five days, the female seven in the first six days. The male removed 15 in the last eight days, the female six. Thus excreta were disposed of after 28 per cent of the feedings, a figure that compares well with the median rate of 25 per cent for 35 studies in 28 species (Nice, 1943: 237).

DEVELOPMENT OF THE YOUNG

One of the Least Flycatcher nestlings was taken by Collias ". . . for a while from the nest early on the second day after it had hatched, and it gave very light notes, each sounding like *tsip*, whenever it was shaken gently (in imitation of the parent landing on the nest), or rubbed gently on the head and foreback (in imitation of parental brooding), or on being warmed after having cooled a bit."

As to comfort movements, preening was first seen at seven and eight days; it was vigorously performed at 12 to 13 days. Wing fanning was first noted at 10 days, stretching wings and legs up and also wing and leg sidewise at 11 days, stretching both wings down at 12 and 13 days, scratching the face over the wing at 12 days and shaking selves at 13 days. Pecking at feathers on the rim of the nest and at the supporting branch was seen at 12 and 13 days.

On 27 July the 14-day nestling had left before 0937. Fourteen days is the age of departure given by de Kiriline and MacQueen; Davis says this occurs about the 15th–16th day. The 13-day nestling was sitting on the edge of the nest, fanning its wings, stretching both wings down, napping with head in the scapulars and preening. It did not flutter its wings when fed. It snuggled down into the nest but soon was up again on the edge, fanning madly; it jerked its short tail up and down, then hopped across the nest. The parents brought eight

meals in 47 minutes. At 1026 it climbed out, fluttered 25 cm. up the branch, then flew 30 cm. to a small branch. A parent came to the nest, took two fecal sacs and left. The baby sat 60 cm. away preening. Six minutes later—at 1032—it turned about and flew out of sight. It was not possible for us to find either of the fledglings again.

SUMMARY

A nest of the Least Flycatcher with two young was watched from one to four hours each day for 13 days for a total of 23 hours. The female brooded during the first four days from 70 to 80 per cent of the time watched; during the next two days she brooded 65 per cent. The brood was fed by both parents on an average of 5.7 times an hour during the first five days, 8.4 times an hour during the next five days, and 12 times during the last three days, the average for the whole time being seven. This compares closely with Davis' (1959) average of 7.2 times an hour for 25.5 hours' observation at a nest with two young. Excreta were eaten or removed after 28 per cent of the feedings. Vocal signals used by parents and young at the nest are described. Ages at which seven comfort movements were first seen are given, as well as an account of the nest leaving of the last fledgling at the age of 13 days.

LITERATURE CITED

BENT, A. C. 1942. Life histories of North American flycatchers, larks, swallows and their allies. U.S. Nat. Mus. Bull., **179**: 1–555.

DAVIS, D. E. 1959. Observations on territorial behavior of Least Flycatchers. Wilson Bull., **71**: 73–85.

KENDEIGH, S. C. 1952. Parental care and its evolution in birds. Illinois Biol. Mon. **22** (1–3), 1–358.

DE KIRILINE, L. 1948. Least Flycatcher. Audubon Mag., **50**: 149–153.

MACQUEEN, P. M. 1950. Territory and song in the Least Flycatcher. Wilson Bull., **62**: 194–205.

NICE, M. M. 1943. Studies in the life history of the Song Sparrow. II. Trans. Linn. Soc. N.Y., **6**: 1–328.

SAUNDERS, A. A. 1938. Studies of breeding birds in the Allegany State Park. New York State Bull., **318**: 1–160.

SKUTCH, A. F. 1960. Life histories of Central American Birds. II. Pacific Coast Avifauna, **34**: 1–593.

5725 Harper Avenue, Chicago 37, Illinois, and Department of Zoology, University of California, Los Angeles 24, California.

NOTES ON THE BEHAVIOR OF THREE COTINGIDAE

BARBARA K. SNOW

DURING a three-week visit to British Guiana in March 1960, three species of Cotingidae of different genera were briefly studied: the White Bellbird *(Procnias alba)*, the Greenheart Bird *(Lipaugus cinereaceus)*, and the Calf or Capuchin Bird *(Perissocephalus tricolor)*. There has been little published on the behavior of these species. For British Guiana, Chubb (1921) draws on the works of Schomburgk (1848), Quelch (1890), Beebe (1910), and Brown (1876), and gives a description of some of the calls and the habitats. The Cotingidae are a family so diverse in appearance and size, that any similarities in their habits and social organization are of interest. Some similarities were found, although more problems were discovered than solved. But, in view of the scant knowledge of the family, unsolved problems seem worth recounting.

It will be helpful occasionally to compare the behavior of the Cotingidae studied in British Guiana with that of the Bearded Bellbird[1] *(Procnias averano)* at present being studied in Trinidad (B. Snow, unpublished). This species is highly sexually dimorphic, with the female cryptically colored. The male, a spectacular mainly black and white bird, devotes all his time to calling from a territory in the forest in which he also feeds. The call is very loud and far reaching and advertises his presence to the female and possible rivals. When the female is ready to mate, she visits the male in his calling territory. Copulation takes place on a special branch after a preliminary ritualized display by the male. There is no other contact between the sexes, the female undertaking all nesting activities by herself, usually at some distance from the males' calling territories. The adult males appear to be slightly sociable and prefer a calling territory within earshot of another male. The immature males are more sociable, and two or three will call within 16 meters of each other.

THE WHITE BELLBIRD

A male White Bellbird was first watched for three-quarters of an hour on 13 March calling on a steep hillside in the Kanaku Mountains

[1] I prefer this name to Black-winged Bellbird or Mossy-throated Bellbird, the former of which does not refer to the bird's most striking character, while the latter gives a misleading idea of the mass of black wattles that dangles from its throat.

about 60 meters above Nappi Creek. It was relocated on the same hillside two days later and watched for four and three-quarters hours throughout the middle of the day. On these two days it remained within approximately a quarter square mile of steep hillside forest, which contained high trees of 30 meters and more, but also had many gaps in the upper canopy due to the steep, rocky nature of the valley. The bird called for 78 per cent of the five and a half hours it was watched, using several horizontal, bare perches 15–20 meters up. The two perches from which it called most of the time were a horizontal, dead branch and a horizontal liana, both of which possessed a spring-

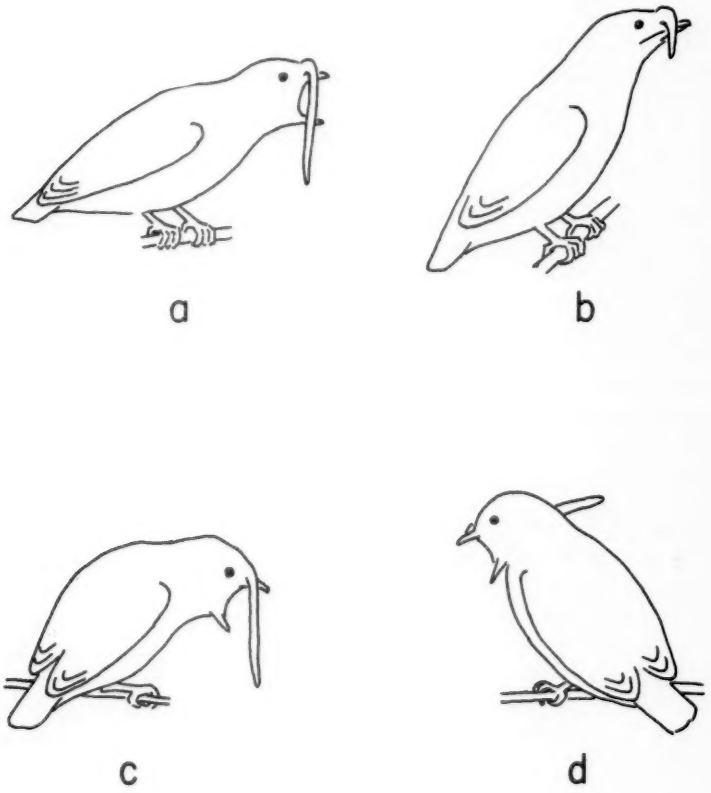

Figure 1. Postures of the White Bellbird: (a) during the *doi-ng* call; (b) with wattle contracted before flying off to feed; (c) and (d) when making the *ding-ding* call.

board quality possibly of importance in a display described later. When calling, the White Bellbird always faced downward into the valley, never up the hillside, which would doubtless have reduced its carrying power. In this it differs from the Bearded Bellbird, which frequently turns on its perch to call in the opposite direction.

The bird has two calls. The most usual is a dissyllabic *doi-ng doi-ng*, which lasts two to three seconds and is repeated four to six times a minute. This must be the *dor-ong* described by Brown (1876). It is a very musical and attractive sound, each *doi-ng* being a chord containing several notes. The second *doi-ng* is slightly shorter and higher pitched. Just before calling, the bird leans forward; then the throat is distended and the bill opened widely and held open while the two syllables of the call are uttered. During the calling the wattle hangs down to the level of the bird's breast (Figure 1a). Previously the wattle has been portrayed as sticking upward in a spike (*e.g.*, Chubb, 1921), but I saw no evidence of this. However, I was much surprised, after watching the bird with its long, pendulous wattle continuously for one and one-half hours, to see as it stretched and prepared for flight the wattle contract to a third of its former length (Figure 1b). Immediately afterward the bird flew out over the tree tops and down the hillside, doubtless to feed.

The second call is a sharp, staccato *ding-ding* lasting one second. It is usually interspersed among the *doi-ng* calls, although once five were made consecutively within two minutes. To make this call the bird under observation leant well forward so that the bill was pointing downward, inhaled air causing the throat to bulge, turned to the right to make the first *ding*, then with beak still wide open rotated its body rapidly through approximately 100° to make the second *ding* facing to the left (Figure 1c and 1d). While turning rapidly from right to left, the wattle flew out to an almost horizontal position. I watched the bird make over 40 of these calls, and each time it moved from right to left. In order that the wattle should not accidentally go into the wide-open gape as the bird swung round, it was essential for it to be hanging on the right of the beak before the call was started. Only three times during the two days when I was watching this individual was the wattle seen hanging to the left of the beak, and on each occasion, prior to making the *ding-ding* call, the bird leant forward and maneuvered it back to the right side. I regretted the lack of opportunity to find out whether there are "left-wattled" as well as "right-wattled" White Bellbirds.

Once the *ding-ding* call was accompanied by a more elaborate display movement. The call began as usual with a *ding* call directed to the

right, then while making the second *ding* the bird jumped with a flutter about two feet to the left, at the same time turning to face in the opposite direction. It then repeated the movement, again turning to the left so that it was in the same position as when it started. The dead, horizontal branch on which it did this display seemed to act as a springboard to assist it in the movements.

The jump to the left with the *ding-ding* shows some similarity to the precopulation display of the Bearded Bellbird. This species usually calls in a stationary position, but, as an immediate prelude to copulation, the male leaps with a loud *clonk* along the whippy, horizontal side branch of a sapling, lands beside the female, and then mounts her; this movement is also sometimes practiced when the female is not present. No other bellbirds were seen near the male White Bellbird, but it seems possible that the jump to the left with a *ding-ding* is a precopulatory movement that the bird was practicing. If this is so, the fact that the male always swings the same way when making the *ding-ding* call would give the female foreknowledge as to the side from which he was going to approach her. If the male White Bellbird, like the Bearded Bellbird, has no relationship with the female except that of copulation, a stereotyped, precopulatory movement may be necessary to enable the two birds, otherwise strangers to each other, to synchronize in mating.

Both adult and nestling Bearded Bellbirds feed exclusively on the fruits of various trees. This is probably the chief factor emancipating the male from all domestic duties. Judging from the large proportion of time the male White Bellbird was able to devote to calling, it seems probable that this species also feeds largely or entirely on fruit. Several

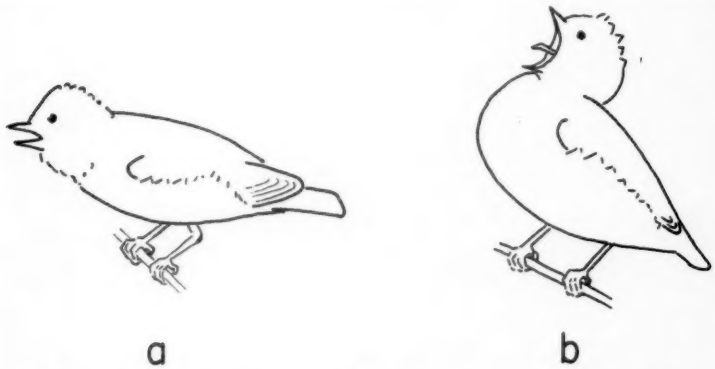

Figure 2. The calling postures of the Greenheart Bird: (a) during the preliminary *groo, groo* call; (b) when making the *pi, pi, y-o* call.

times it was seen regurgitating seeds, some of which were picked up and proved to be a species of Lauraceae, a family of trees providing much of the Bearded Bellbird's food.

THE GREENHEART BIRD

The Greenheart Bird or Pi-Pi-yo is a thrush-sized, gray bird. It is seldom seen, but its extremely loud, ringing call, *pi, pi, y-o,* makes it well known to all who have been in the Guiana forests.

The sexes are very similar. Chubb (1921) reported that the female differs from the male in having the outer aspects of the wing and the tips of the tail feathers tinged with rufous. However, this needs confirmation. It is possible that the rufous tinge to the wing and tail is just a juvenile character, as four of the five birds sexed as females in the Georgetown Museum lack it, and one of the four birds sexed as females in the British Museum also lacks it.

I watched the Greenheart Bird fairly intensively for a total of 23½ hours over a period of six days. The birds studied were near Wineperu on the Essequibo River, in a stretch of forest from which the Greenheart timber *(Ocotea rodiei)* of economic value, about 2–3 per cent of the dominants, had been cleared 15 years previously. Notes were also kept on five calling grounds in a forested area in the foothills of the Kanaku Mountains.

All the calling birds of which a good view was obtained lacked the chestnut markings, and it seems probable that it is only the males that hold territories in the calling grounds and give the *pi, pi, y-o* call. This call is extremely loud and audible through approximately 300–400 meters of forest. Out in the open there is no doubt that it would be audible a great deal further. Close at hand, the call seems to be more nearly described by *qui, qui, y-o.* While calling, the bird has the feathers of the head erected to form a slight crest, and the pale-gray flank feathers puffed out covering part of the wing. As a preliminary to the call, the bird leans forward, opens the bill slightly and at the same time utters two somewhat dovelike notes, *groo groo,* audible for about 100 meters (Figure 2a). The first note is slightly lower pitched than the second. From the forward position held in the *groo* call, the bird suddenly jerks its head back so that it almost rests on its scapulars. At the same time the beak is opened very wide, displaying an orange gape, and the first *qui* note is uttered (Figure 2b). With the beak still open, the bird gives another jerk back for the second *qui* and then relaxes forward and closes the bill with the *y-o* note. This final note has an indescribable ringing quality and carries further than the more-piercing *qui* notes.

When watching a bird call one morning against the early-morning light, it was evident that much air was expelled with the *qui, qui, y-o* but not with the *groo groo* notes, when probably air is inhaled. The quite violent and ritualized bodily movements involved in the call give the impression of being physically essential to the production of the call, but are probably really a visual display, as the bird occasionally makes another equally loud call without any movement.

The *qui, qui, y-o* lasts about two seconds and the preliminary *groo groo* also about two seconds. The number of calls per minute varies greatly, from one or two per minute, when the bird may also be occupied with preening, to eight per minute. On one occasion 12 per minute were witnessed. The bird was very excited, and this rapid calling was followed by a different call and behavior, described below, which possibly heralded the approach of a female.

One individual, A, watched for 16½ hours at the Wineperu calling ground, had a territory approximately 75 meters by 35 meters. It was seen in this territory on six successive days. Fortunately, this individual had the tip of the right, outer tail feather missing, so it was possible to check its identity. It was not seen calling outside its territory. The 16½ hours spent watching this individual covered the whole of a day from 0645 to 1645 and duplicated many of the hours. Seventy-seven per cent of this time was spent calling in the territory; the remainder of the time the bird was silent, and I usually lost sight of it. The silent periods recorded usually lasted for from 5 to 10 minutes, but a period of 23 minutes was once recorded.

Very occasionally, while calling, the bird would flutter up to a nearby leaf and take an insect. But judging from the short time taken to feed, fruit must be its main diet. Like the Bellbirds and Calfbirds, it was frequently seen regurgitating fruit seeds. Twice it was seen taking fruit, once from a melastomaceous tree of about 13 meters and from an unidentified tree of about 32 meters. Most of the fruit must have come from high up, as usually after a spell of calling, the bird would disappear into the upper canopy, where it would be silent and was presumably feeding.

There appears to be a strong social bond between neighboring birds. Thus the individual A had two neighbors, B and C, with which it synchronized its day so that all three birds, but more particularly A and B, would tend to have their silent periods and period of high- and low-tempo calling at the same time. When all three birds were calling at a fairly high tempo, such as six calls a minute, the calls were timed to follow each other and not overlap. A and B, timing their calls alternately, would reach a tempo of eight per minute. As the full call of

groo groo, qui, qui, y-o took approximately four seconds, careful timing was required, and it could only be accomplished by one bird starting its *groo groo* call when the other was terminating with its *y-o*. These bouts of alternate calling were made when the two or three neighbors were calling near each other, probably not more than 100 meters apart.

The bird usually calls from below the canopy, perching on fairly thin, horizontal branches 6 to 16 meters up. Occasionally, it will call from higher perches. It moves its perch rather frequently, calling from all parts of its territory with no apparent preference for any particular perch. When excited, A was seen on several occasions to fly down to perches 4 to 5 meters above the ground, where it hopped about from perch to perch while calling at a very high tempo. The Bearded Bellbird flies down to a lower perch when a female appears, and here it displays prior to mating. Although I saw no other bird when A flew to these low perches, it seems probable that one may have been present and visible to A.

Two birds with abnormal calls were heard at different calling grounds in the Kanakus. These birds were reheard at the same place on subsequent days and give further proof that each bird has a fixed area in the calling ground. One bird every fourth or fifth call gave a *qui, qui, y-ee*, the intervening calls being normal. The other bird always used an abnormal timing, so that after the first, unusually quick *qui*, there was a one-half second pause before the final *qui, y-o*. This bird frequently did the *groo groo* calls alone. The young male Bearded Bellbird takes many weeks to perfect its call, and the second bird may have been a young bird learning the call.

Another call made very occasionally by the calling birds holding territories was a loud, whistling *wee-oo* repeated several times. This call was usually made before or after a silence of five or more minutes. It was also made early in the morning and in the evening. In the Kanakus, where we camped in the middle of a calling ground, the *qui, qui, y-o* calling started around 0645 hours and continued until about 1715 hours in the evening. But each morning, sometimes as much as 20 minutes before the day's calling started, a few *wee-oo* calls would be heard, and the same would happen in the evening after the calling had finished for the day. There was no special body movement made with this call, although it was equally as loud as the *qui, qui, y-o* call. It seems likely that this is a preliminary contact call between neighbors who have temporarily lost contact through silence. From the following incident, it looks as if it may also be a contact call between the sexes. The individual A flew from the borders of its territory, where it had been calling, into the lower branches of a sapling in the center of the territory.

Here it called *qui, qui, y-o* at the rate of 12 per minute, evidently excited, moving from branch to branch, and frequently turning on the branch to call in the opposite direction. It suddenly stopped calling and hopped up the sapling, giving a low, whistling *queue queue*, probably not audible for more than 15 meters. At about 10 meters, it stopped and called *wee-oo*, which another bird, somewhere above, answered with a *wee* call. This calling and answering was repeated two or three times before A flew off and there was silence. It seems possible that the answering bird was a female, although unfortunately I never saw it.

It is probable that the Greenheart Bird's calling grounds are a type of lek, where each male owns quite a large territory from which it derives a proportion of its food. I gathered from residents in British Guiana, who frequently visit the forest, that they have not noticed any seasonal change in the amount of calling but have the impression that the bird calls throughout the year, and also that it calls in the same places over the years. A loud call, with effectiveness increased by numbers, and a fixed locality are probably both important features facilitating contact between the sexes. The extreme loudness of the Greenheart Bird's call has presumably evolved through intraspecific competition, as have the extravagant visual displays of other lek birds.

THE CALFBIRD

The Calf or Capuchin birds were watched for a total of nine and one-half hours. Seven and a half hours were concentrated into one day; the other two hours were in the early morning of the following two days. Even so short a time brought to light some very interesting and puzzling facts about these extraordinary birds.

The Calfbird is a fairly large bird, 340 mm. long. Its general color is chestnut brown with black upper tail coverts, tail and flight feathers. The under tail coverts are bright orange-brown and are important in display. The bird has bare, bluish-gray skin on the face. The sexes are similar. The far-carrying, *mooing* call, very like the lowing of a calf when heard in the distance, was described by Schomburgk (1848) and has been mentioned by many subsequent writers.

The piece of forest at the foot of the Kanuku Mountains in which a display area was found consisted mainly of trees not more than 25 meters high with a fair proportion of secondary growth due to felling. There was another display area, heard but not visited, about a quarter of a mile away from the one where I watched. The display took place on two adjoining trees that were mostly leafless, particularly the lower branches. The bareness of these lower branches, about 16–20 meters up,

was almost certainly due to the industry of the Calfbirds, as two different birds were seen to snap twigs off these display branches and drop them. Preparation of a place for displaying is seen in another member of the Cotingidae, the Cock of the Rock *(Rupicola rupicola)* (Guppy, 1958: 90–92), and has been found in some species of manakins (Pipridae), a closely related family.

Five birds, two couples and a single bird, commonly came to call and display at these display branches. Their identity on consecutive days was presumed from the similar positions they took up when displaying. The single bird, A, took up a central position, with one couple, B, four to five yards away on one side, and the other couple, C, four to five yards away on the other side. In these positions all five birds would give the *mooing* call, sometimes in unison and sometimes individually or in couples.

When two birds give the *moo* call together, they come to within a few inches of each other; then both face in the same direction, lean forward, cock their tails, and puff out their orange-brown under tail coverts. At the same time they open their beaks and utter a growling call, *grrr*, probably by the inhalation of air (Figure 3a). In unison the birds then puff up all the feathers of the upper part of their bodies and slowly assume an upright and then a leaning-back posture (Figure 3b); at the same time tails are fanned and depressed, so that tufts of the bright, orange-brown under tail coverts appear on either side of the black tail (Figure 3c). While the birds have been assuming this upright posture, the *grr* has changed to an *aaa;* then, while in this puffed-up, leaning-back position, the *moo* call is made. The bill is closed during the *moo*, and the air is probably blown out through the gape. The air appears to be stored in sacks at either side of the neck, which at the beginning of the call are distended and become dented as the call progresses. The *moo* is by far the loudest part of the call, and at a distance is frequently the only part of the call heard. From a position near the bird, the full sequence is most closely described by *grr-aaa-oooooo*.

Two other calls were heard. One of these, *grr-aaaa-aw*, is almost as loud as the *moo* call, and is in many ways similar: the *grr* starts with the bird leaning forward, and the *aaaa* is made with the beak open as the bird becomes more upright; but there the call ends with an *aw*, as the beak closes and the bird never reaches the leaning-back, puffed-up position of the *moo* call. I did not see this call performed in unison, and my impression was that it was made when the excitement was not sufficiently great to produce a *moo* call. The other call heard was a *wark*, repeated once every two seconds for up to 10 minutes at a time.

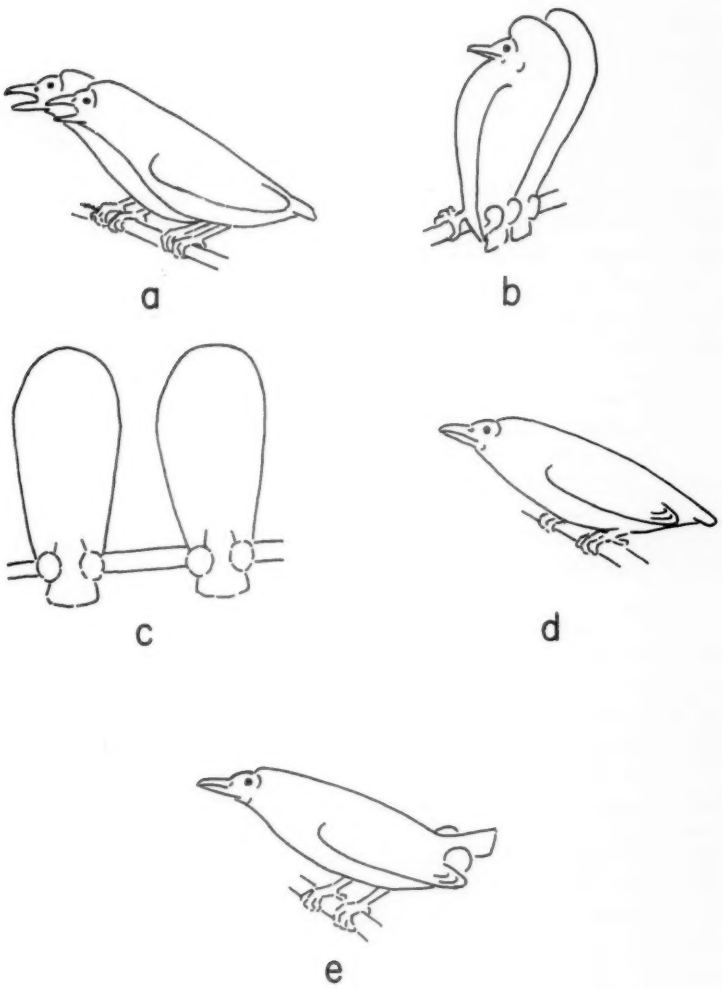

Figure 3. Display postures of the Calfbird: (a), (b), and (c) two birds making the *moo* call in unison; (d) and (e) postures assumed by single birds.

This call was not audible beyond a range of about 30 meters. The single bird A was seen making this call and also one individual from a couple; but the two birds of a couple were not seen to make it together. While making this call, the bird has its feathers flattened, including the orange under tail coverts.

The individual A frequently hopped about the display branches, landing in a pointed position (Figure 3d) and holding it for several seconds. This position shows striking similarities with the male Bearded Bellbird's display performed between two branches of the mating sapling, when it first espies a visiting female. A rather different version of the pointed position (Figure 3e), with the tail cocked up and the under tail coverts erected, was several times taken up by the bird of couple B and couple C, which was nearest to A. It looked like the position a female might adopt when inviting copulation, but unfortunately it was not possible to determine the sex of any of the birds.

Besides the five birds watched at the bare display branches, there were sometimes other birds calling nearby. They appeared to move about and not call from any one place. At the beginning of a bout of display, one bird calls, and immediately other birds begin to fly in to the display center, often stopping on the way to *moo*. They fly in singly just below or through the canopy, with a rapid, undulating flight during which the wings make an audible whirr.

The birds were present in the display area and calling for 74 per cent of the seven and one-half hour watch on 14 March. The longest period of silence was 38 minutes near midday. From 1450 to 1800 hours some birds were continually present and calling, and in the early morning there was also a concentrated period of display. Like other Cotingidae this species is probably able to spend so much of its time calling and displaying because of its fruit-eating habits. It frequently regurgitates the hard seeds of the fruits it eats. Fifteen of these were picked up from below the display branches; all but three were a species of *Aniba*, a tree belonging to the Lauraceae family, which provides so much of the food of the Bearded Bellbird.

The purpose and import of all these displays remain a mystery. The two most likely explanations are that displaying is either a communal activity to which paired birds come as a social stimulus, or it is a lek of males to which females resort in order to mate. If it is a lek and the displaying couples are males, then this shows some analogy to the Blue-backed Manakins (*Chiroxiphia pareola*), in which two males cooperate for part of the display (Snow, 1956). It is unusual for the plumage of the sexes to be similar in a lek bird; but possibly it is a hole-nesting species as two other genera of Cotingidae (*Attila* and *Tityra*) are known

to be. If this is the case, there would not be the same necessity for the female to acquire a less-conspicuous plumage.

SUMMARY

1. Field notes are presented on the calls and behavior of the White Bellbird *(Procnias alba)*, the Greenheart Bird *(Lipaugus cineraceus)*, and the Calfbird *(Perissocephalus tricolor)*.

2. The calls of the male White Bellbird and some of the accompanying movements are described, including the position of the wattle. While under observation, the male called for 78 per cent of the time and stayed within a restricted area of forest.

3. The various calls of the Greenheart Bird are described. The observations suggested that the main call is made by the males, who occupy adjacent territories, forming a type of dispersed lek.

4. The communal display of the Calfbirds includes a loud, synchronized calling by couples perched side by side. The birds use special display branches from which they clear the twigs and leaves.

LITERATURE CITED

BEEBE, M. B., and C. W. BEEBE. 1910. Our search for a wilderness. Henry Holt and Co., London and New York. xix + 440 pp.

BROWN, C. B. 1876. Canoe and camp life in British Guiana: E. Stanford, London. x + 400 pp.

CHUBB, C. 1921. The birds of British Guiana. Vol. 2. B. Quaritch, London. xxviii + 615 pp.

GUPPY, N. 1958. Wai-wai: through the forests north of the Amazon. New York.

QUELCH, J. J. 1890. On the upper Demerara River: about and above the Great Falls. Timehri (*2*), **4**: 98–133.

SCHOMBURGK, R. 1848. Reisen in Britisch Guiana. Vol. 3.

SNOW, D. W. 1956. The dance of the manakins. Animal Kingdom, **59**: 86–91.

Simla, Arima Valley, Trinidad, West Indies.

VESTIGES OF A PROPRIETARY INTEREST IN NESTS BY THE BROWN-HEADED COWBIRD PARASITIZING THE KIRTLAND'S WARBLER

HAROLD F. MAYFIELD

SINCE the Brown-headed Cowbird, *Molothrus ater*, depends exclusively on other species to incubate its eggs and to care for its young, and since its fleeting visits to lay or remove eggs are rarely observed, we might be led to suppose its nesting drive to be fully extinguished by this time in its evolutionary history. However, I believe such is not quite the case. On the contrary, I believe the female cowbird in many instances gives a continuing and discriminating attention to the nests in which it lays its eggs, and consequently might be said to manifest, in moderate degree, a vestigial proprietary interest in those nests. I have never known the male cowbird to touch a nest.

This impression has developed gradually over the years of my study of the Kirtland's Warbler, *Dendroica kirtlandii*, a study that became in part also a study of the cowbird, since the reproductive lives of these two birds are so closely entwined.

Watching nest building intently. The cowbird's interest in the nest of the Kirtland's Warbler, as has been noted with other host species, first becomes apparent during nest building. At this time the female cowbird sits on an exposed perch some distance away and watches for extended periods while the warbler works. The span of attention of the cowbird is far longer than would be required merely to locate the nest. In a higher animal we might interpret this behavior as vicarious participation, and the term may not be totally amiss here. Certainly, the cowbird's involvement would seem to be deeper than that of a mere onlooker, if it is brought to ovulation as a result of this experience, as Hann has suggested (1937: 207).

Looking into the nest at intervals. Occasionally, when the owners of the nest are not present, the female cowbird walks up to the nest and peers into it. This may occur very early, even before the nest is finished. Hann (1941: 220) in his study of the Ovenbird, *Seiurus aurocapillus*, concluded that the "cowbird makes regular trips of inspection to nests." Once at a nest of the Kirtland's Warbler that was almost finished but had not yet received its first egg, I saw a cowbird walk up to the nest, poke its head through the overarching canopy of grass, look for a moment into the cavity, and then fly away. This occurred two hours after sunrise and thus much later in the day than the usual egg-laying visit.

On another occasion, in the semidarkness before dawn I saw a cowbird walk to a nest, fly away, and then return 10 minutes later, laying an egg at one of the two visits. The dim light and the ground cover prevented me from being sure whether the egg was laid in the first or second visit. Then, on the following morning, which was still one day before the first warbler egg arrived, the cowbird returned and looked into the nest at seven, nine, and ten o'clock.

Doubtless, most of the cowbird's attention to nests centers in the building and egg-laying periods—that is, before incubation begins. At these times the cowbird is not likely to be opposed by the hosts, since small songbirds typically spend a very small part of these days near the nest. Also such cowbird visits are not likely to be recorded, for it is not often that a human observer will be watching a nest constantly from concealment at these stages.

Cowbird visits are probably less frequent after incubation begins. Now the nest is closely defended, and the cowbird is usually routed before it gets to the nest. Further, it appears hesitant in manner and more easily repelled in these broad-daylight visits than in the predawn, egg-laying visits. Hann (1937: 202) saw a cowbird push a shrieking Ovenbird right out of its nest in order to enter and lay an egg. But I saw a female Kirtland's Warbler put an unresisting female cowbird to flight three times in two days when the cowbird walked up to within a meter of the nest. This nest held young birds almost ready to leave.

Dubois (1956: 286) saw a female cowbird strike with its bill into the nest of a Song Sparrow, *Melospiza melodia*, injure one of the four nestlings and carry away another. This nest, like that of the Kirtland's Warbler, was on the ground. Dubois does not mention seeing the adult sparrows; so the nest was presumably undefended at the moment. I suspect that molestation of nests so late in the cycle is rare.

In my examples, the cowbirds were not banded, and therefore my inference that repeated visits to the same nest were made by the same cowbird is not proved. However, this inference is supported by the findings of others—particularly Friedmann (1929: 175), Nice (1937: 154), and Laskey (1950: 167)—that each cowbird has a definite home range. Also the idea that a host nest is normally the object of attention for one cowbird exclusively is supported by the fact that I have never found more than one cowbird egg laid in a day in a Kirtland Warbler's nest, although 52 per cent of parasitized nests in my study received more than one cowbird egg each (Mayfield, 1960: 148).

Here I have not considered egg-laying visits after the normal time—during incubation, with nestlings present, and in abandoned nests.

These "late" cowbird eggs comprise about 10 per cent of the total (Mayfield, 1960: 159), but I believe they indicate, not a continuing interest in nests, but an unpremeditated use, as might occur if a cowbird ready to lay an egg were to find the intended nest destroyed.

Visiting the nest repeatedly to remove eggs. The cowbird's continuing interest in the Kirtland's Warbler nest is shown by the fact that it removes more eggs than it lays, even though some parasitized nests do not lose any eggs; that is, a nest losing any eggs often loses several, presumably as a result of separate visits by the cowbird.

To get a measure of the total loss, it is not sufficient simply to count eggs as they appear and disappear. Too many are removed before they are seen by anyone. Therefore, I prefer to deduce the losses by comparing a sample of parasitized nests with a sample of nests that have not been molested by cowbirds, as follows:

Eggs in Kirtland's Warbler Nests

(142 nests)

Warbler eggs in 67 nests not parasitized		310
Warbler eggs per nest not parasitized		4.63
Warbler eggs in 75 parasitized nests		205
Warbler eggs per parasitized nest		2.73
Warbler eggs lost per parasitized nest		1.90
Cowbird eggs in 75 parasitized nests		125
Cowbird eggs per parasitized nest		1.67
Warbler eggs lost per cowbird egg gained,	$\frac{1.90}{1.67}$	1.14

(Nests were included only if clutches were judged complete because seen on at least two days without increase.)

Removing eggs only from nests it is using. It is significant that the cowbird's drive to remove eggs is directed only at nests in which it has laid or will lay its own eggs. Even though there are other Kirtland's Warbler nests in the vicinity, these other nests almost never lose eggs without the destruction of the entire clutch at one time, a kind of destruction not attributed to the cowbird. Therefore, the cowbird normally seems not to seek eggs for themselves but takes eggs only from nests it is using for its own.

Removing only the hosts' eggs. The cowbird does not remove eggs at random, but is able to discriminate between its own and the hosts' eggs, some of which are treated as other birds might be expected to treat "foreign objects." I have 13 definite instances where cowbirds

removed eggs from nests containing both cowbird eggs and Kirtland's Warbler eggs, and each time the cowbird took only warbler eggs. In these instances the cowbirds were confronted with choices among a total of 23 warbler eggs and 19 cowbird eggs. The odds against 13 correct choices without an error are 3,000 to 1 by chance alone.

Probably the cowbird discriminates on a basis of size rather than color or pattern. Both kinds of eggs are whitish and lightly speckled, but the warbler egg is smaller. At the nest of the Ovenbird the cowbird has more difficulty in distinguishing the hosts' eggs, which are nearer the size of its own. But even here Hann (1937: 204) noted the loss of only four cowbird eggs as against 30 Ovenbird eggs lost. The mean size of Brown-headed Cowbird eggs in Kirtland's Warbler nests is 20.9 by 16.5 mm. ($N = 24$); of Ovenbird eggs, 20.3 by 15.6 mm. ($N = 48$, Hann, 1937: 172); of Kirtland's Warbler eggs, 18.1 by 13.9 mm. ($N = 154$).

Never emptying the nest completely. I have never known the cowbird to take the only egg present in a Kirtland's Warbler nest. Long ago Burroughs (1887: 30) noted that the cowbird takes an egg only when the nest contained "two or more eggs," and Hann (1941: 212) found this to be true also in nests of the Ovenbird. However, it is only fair to point out that few Kirtland's Warbler nests were found so early and watched so closely that a first egg might not have been laid and removed unseen.

This subtle distinction by the cowbird may have survival value, because songbirds are more likely to desert if the nest is emptied than if its contents are merely reduced; on the other hand, an inattentive host might not be aware of the loss of an only egg if it were replaced by a cowbird egg before the host's next visit.

Destroying several eggs in a crowded nest. I have a small number of examples suggesting that a cowbird removing eggs from a crowded nest may create havoc in it. Not surprisingly, these instances are few, because the cowbird is most active early in the egg-laying stage and because full clutches are likely to be under incubation and therefore defended. (The Kirtland's Warbler normally begins incubation on the next-to-last egg.)

In nests that had complete sets of eggs when cowbirds visited them to lay and to remove eggs, the results were as follows:

Cowbird Damage to Full Clutches of Kirtland's Warbler Eggs

(7 nests)

	Warbler eggs	*Cowbird eggs*
Before cowbird damage	32	1*
After cowbird damage	8	9
Cowbird eggs added, 8		
Warbler eggs destroyed, 24		

* One nest held a cowbird egg laid earlier.

The resultant set of eggs in each instance was a clutch of one to four eggs, that is, about the usual number to be found in a nest at the usual time of a cowbird's visit. Excluded from this table were four other full clutches that received additional cowbird eggs without loss.

SUMMARY

The Brown-headed Cowbird still retains vestiges of a nesting drive shown in ways suggesting a proprietary interest in the Kirtland's Warbler nests it parasitizes, as follows:

1. Watching nest building intently.
2. Looking into the nest at intervals.
3. Visiting the nest repeatedly to remove eggs.
4. Removing eggs only from nests it is using.
5. Removing only the host's eggs and not its own.
6. Never emptying the nest completely.
7. Destroying several eggs in a crowded nest.

LITERATURE CITED

BURROUGHS, J. 1887. Birds and bees. Houghton Mifflin, Boston. 88 pp.

DUBOIS, A. D. 1956. A cowbird incident. Auk, **73:** 286.

FRIEDMANN, H. 1929. The cowbirds. Charles C. Thomas, Springfield, Ill. viii + 421 pp.

HANN, H. W. 1937. Life history of the Oven-bird in southern Michigan. Wilson Bull., **49:** 145–237.

HANN, H. W. 1941. The cowbird at the nest. Wilson Bull., **53:** 211–221.

LASKEY, A. R. 1950. Cowbird behavior. Wilson Bull., **62:** 157–174.

MAYFIELD, H. F. 1960. The Kirtland's Warbler. Cranbrook Inst. of Sci., Bloomfield Hills, Mich. 226 pp.

NICE, M. M. 1937. Studies in the life history of the Song Sparrow, I. Trans. Linn. Soc. New York, **4:** 1–242.

River Road, RFD, Waterville, Ohio.

SOME FEDERAL CONTRIBUTIONS TO BIRD CONSERVATION DURING THE PERIOD 1885 TO 1960

DANIEL L. LEEDY

THE year 1960 may be regarded as the 75th anniversary of the entry of the government of the United States of America into the field of bird conservation. Since the first appropriation of $5,000 for fiscal year 1885 and the original federal unit to carry out a program of ornithological research were due, in large measure, to the influence of the American Ornithologists' Union, it seems fitting to review some of the contributions made to bird conservation by the federal government in the intervening 75 years.

It will be recalled that the Union was organized as an offshoot of the Nuttall Ornithological Club on 26 September 1883. Three committees were formed at its first "Congress" (Cameron, 1929). These committees dealt with the English sparrow, faunal areas, and bird migration. The latter two committees were merged to form an active committee on the migration and geographical distribution of North American birds. It was this committee under the chairmanship of Dr. C. Hart Merriam that prepared a memorial to Congress advocating the establishment of a division of economic ornithology under the U.S. Department of Agriculture; and it was Dr. Merriam, together with his assistant, Dr. A. K. Fisher, who initiated the government's program in bird conservation.

Although the initial studies of food habits and migration in relation to insects and plants were of direct concern to the Division of Entomology, where the work was conducted, the economic status of mammals also was recognized as being important. Accordingly, independent divisional status was given to the investigations of birds and mammals by creation of a Division of Economic Ornithology and Mammalogy on 1 July 1886. During these early years of federal participation in studies of wildlife conservation, members of the American Ornithologists' Union contributed many important observations.

The first bulletin of the new Division was *The English Sparrow (Passer domesticus) in North America*. This 405-page, illustrated work by Walter B. Barrows was published in 1889. In the words of Dr. E. R. Kalmbach, who himself later reported on the analysis of 8,004 English sparrow stomachs (Kalmbach, 1940), Barrows' bulletin ". . . long has been looked upon as a classic among contributions to economic ornithology. Its pages chronicle a history and appraisal of

the economic worth of the English sparrow that can be found nowhere else in the literature of American ornithology."

This publication by Barrows proved to be the forerunner of many well-known publications on investigations of food habits that constituted an important and valuable part of the federal wildlife research program until 1942, when appropriations for this activity were terminated.

Although the food habits of some of the birds, especially adult English Sparrows, were found to be detrimental to man's interests, others were judged to be beneficial. Thus, in transmitting Bulletin No. 15 of the Biological Survey to the Secretary of Agriculture on 3 July 1901, Dr. Merriam stated, "Sparrows are notorious seed eaters, but the precise nature of their food and its effect on agriculture have not hitherto been known with any degree of accuracy. This report, based on extended field observations and an examination of 4,273 stomachs of sparrows, brings out clearly the extent to which several native species feed on seeds of noxious weeds, and shows the value of these birds as weed destroyers." He was speaking of Dr. Sylvester D. Judd's (1901) manuscript on "The Relation of Sparrows to Agriculture," in which the food habits of native sparrows were compared with those of English Sparrows.

Other examples of reports dealing with birds' food habits or with the identification and management of plants utilized as food by birds are publications by Aldous (1942), Beal (1933 and 1936), Cottam (1939), Jones (1940), Judd (1902), Kalmbach (1920 and 1940), Martin, Zim, and Nelson (1951), Martin and Uhler (1939), McAtee (1931 and 1939), Metcalf (1931), and Sperry (1940).

In the later years of food-habits investigations by the Bureau, increased emphasis was given to correlation of food consumed with food available in a given area. Also, increased attention was placed on studies designed to provide information basic to the better management of desirable game species.

In conducting these investigations of food habits, extensive collections of vertebrates, invertebrates, plants, and seeds were assembled and filed systematically for identifying food items. These collections are still intact and available for use when circumstances warrant additional investigations.

During the period 1896 to 1906 extensive biological explorations assumed increasing importance. Subsequent to the initiation by Dr. Merriam of his "biological survey" in northern Arizona, out of which developed his life-zone concept, the Division of Ornithology and Mammalogy became the Bureau of Biological Survey on 1 July 1905. In 1940 the Bureau of Fisheries, whose origin dates to the founding of

the U.S. Fish Commission in 1871, and the Bureau of Biological Survey were merged as the Fish and Wildlife Service in the Department of the Interior. The Fish and Wildlife Act of 1956 provided for an Assistant Secretary of this Department for Fish and Wildlife, an Office of the Commissioner of Fish and Wildlife, and two Bureaus, the Bureau of Commercial Fisheries and the Bureau of Sport Fisheries and Wildlife. The latter Bureau encompasses the current wildlife activities described in this paper.

The principal interest of the A.O.U. in the work of the Biological Survey has been in the field of bird distribution and migration. A *Report on Bird Migration in the Mississippi Valley in the Years 1884 and 1885* by Professor Wells W. Cooke was issued as Biological Survey Bulletin No. 2 in 1888. Professor Cooke joined the staff of the Division 1 July 1901, and was responsible for beginning the card file on the distribution and migration of North American birds that continues to be the "court of last appeal" for students in this field. Until his death in 1916 Professor Cooke was a prolific writer on the distribution and migration of North American birds, a long list of publications in the Department of Agriculture series attesting to this fact. All five editions of the A.O.U. *Check-list of North American Birds* draw extensively from this file, which also has been the primary source of data for the distribution and migration sections of the well-known bulletins of the U.S. National Museum by Arthur C. Bent on the *Life Histories of North American Birds*. The file now contains nearly three million cards. Results of the biological surveys and exploratory trips, which have extended from Argentina and Chile to Canada and Alaska, have been published in the North American Fauna series started in 1889, and in technical bulletins. In connection with the life-zone mapping and field explorations, which have taken into account animals in relation to vegetation and climate, considerable attention also has been given to taxonomic studies on birds and mammals. The identification and loan of specimens continue to constitute valuable services to ornithologists throughout the country.

Requests for assistance in reducing or preventing crop depredations by injurious birds and mammals resulted in research for the development and demonstration of damage-control techniques. These activities became an important part of the Bureau program and remain so until this day.

Early in the century the protection and management of migratory birds became an important function of the Bureau and one of profound interest to many citizens, including nature lovers, sportsmen, and conservationists. Laws regulating wildlife came into being, and new pro-

grams of law enforcement and migratory bird research were started. The concept of protecting wildlife through establishment of Federal Wildlife Refuges became a reality. The Lacey Act of 25 May 1900, as amended, outlawed the commercialization of game and excluded the importation of certain birds and mammals that would be injurious to agriculture or horticulture. Although the execution of that part of the Act dealing with importations was given to the Treasury Department, the Bureau of Sport Fisheries and Wildlife frequently is called upon to identify or provide information regarding proposed imports. The Bureau also has enforcement responsibilities for that section of the Lacey Act regulating the interstate shipment of game, for the migratory bird treaty acts, and for the Bald Eagle Act of 1940. Currently, the Bureau has 138 game-management agents whose major responsibility is the enforcement of federal migratory bird laws and regulations. Also, these agents make valuable contributions to bird management and conservation by conducting annual population surveys of migratory game birds and by aiding in bird-banding programs, thus helping to provide information useful in establishing the annual hunting regulations.

Work in bird banding, which, previously, had been conducted by the American Bird Banding Association, was taken over by the Bureau in 1920. Issuance of bands and the maintenance, processing, and analysis of banding records are handled by the Bureau's Branch of Wildlife Research. This clearing house for bird-banding activities has been important in standardizing and facilitating the gathering of valuable data on longevity, migration routes, effects of hunting, and other factors on migratory birds. Records of 11 million banded birds are on file at the international bird-banding laboratory located at the Patuxent Wildlife Research Center, Laurel, Maryland. Ornithologists throughout North America contribute to the banding efforts and, in turn, receive information from the laboratory. A fire on 13 June 1959 destroyed many of the card files but fortunately not the original banding records. The IBM cards are being reconstructed, and soon they will be recorded on magnetic tapes for ease in reproducing them in the future as need arises. This should facilitate materially the problem of analyzing the data now in the band-recovery records.

An important step made possible by bird-banding records and observations of birds during migration was the development of the flyway concept of waterfowl management. The four great flyways, Atlantic, Mississippi, Central, and Pacific, described by Lincoln (1935a, 1935b, and 1950), have served, since 1948, as the basis for the formulation and administration of annual hunting regulations. More recently, banding data have indicated the feasibility of establishing three geographic

management units, Eastern, Central, and Western, for the Mourning Dove (Kiel, 1959). Also, band recoveries are being used increasingly to make annual and shooting mortality estimates for waterfowl. Thus, Geis (1959) calculated that the annual rate of mortality of immature Canvasbacks during the first year was 77 per cent. Annual mortality rates of adults of this species ranged from 35 to 50 per cent. Hunting was estimated to account each year for more than one-half the deaths of Canvasbacks of flying age. His comparison of band-recovery rates in years of different hunting regulations showed that both season length and daily bag limit affected the hunting kill.

The Bureau has made important contributions to bird conservation through its system of National Wildlife Refuges and its wetland management program.

Just as the American Ornithologists' Union had urged the initiation of a federal unit in bird conservation work, so, also, did it support the establishment of the first National Wildlife Refuge, that of Pelican Island off the Florida coast on 14 March 1903. This bird reservation, as it was then called, was especially valuable in reducing the heavy plume traffic that existed in that area. With the help of refuges and the protection of migratory-bird treaty regulations, the egrets and herons have made a remarkable comeback. Additional refuges both for birds and big game have been established since then, until now the Bureau has 275 refuges totaling about 17,500,000 acres of land and water. The 1958 amendment to the Migratory Bird Hunting Stamp Act assures that the net proceeds from the sale of the duck stamps will be used for the acquisition of additional land.

Refuges have been especially valuable in providing critical wintering and/or breeding habitat for such endangered species as the Whooping Crane and the Trumpeter Swan. The story of the Bureau's successful efforts in protecting and managing the few Trumpeter Swans that remained in the United States in 1930, so that today the species appears to be well on its way to recovery, is told by Winston E. Banko (1960). Although recovery of the rare Whooping Crane has not been so successful, the species has responded to the protection afforded it, and as of 1959–1960 there were 33 wild birds compared with 14 when the Aransas National Wildlife Refuge on the coast of Texas was established in December 1937.

Two other programs within the Bureau have made important contributions to bird conservation since the 1930's: the Federal Aid in Wildlife Restoration program established through an act (50 Stat. 917: 16 U.S.C. 669) approved 2 September 1937, and the Cooperative Wildlife Research Unit Program initiated in 1935. Under the Federal Aid

program, expenditures and/or obligations for waterfowl research and land acquisition, and for development, operation, and maintenance costs related to these waterfowl projects from 1 July 1938 to 30 June 1959 amounted to $66,593,039. The federal share for these activities amounted to $49,944,779. In addition, much research has been done on resident game birds through this program.

The Cooperative Wildlife Research Units, of which there are 16 located at land-grant colleges, are supported by the Bureau of Sport Fisheries and Wildlife and the Wildlife Management Institute in conjunction with the Fish and Game Departments and state colleges or universities of 16 states. These Units have facilitated the training of wildlife biologists and have conducted a great deal of research on birds and other wildlife resources. Publications resulting from this research now total more than 3,000. Many of the Unit School graduates, now more than 3,200, hold responsible positions in state, federal, and private conservation organizations.

Mention should be made here, also, of some of the Bureau's research on bird diseases and the effects of pesticides on bird populations. Alexander Wetmore (1918) was one of the early workers to report on "The duck sickness in Utah." Wetmore's work was followed by intensive studies by C. C. Sperry (1947) and Kalmbach and Gunderson (1934), who definitely established that "duck sickness" is a form of botulism caused by *Clostridium botulinum* type C. From these and later studies, remedial measures, including water-level manipulation, "hospitalization," and antitoxin therapy, were developed. These management techniques have been of considerable value to bird conservation. Current botulism studies by the Bureau indicate a possible relationship between populations of invertebrate bottom fauna of marshes and the severity of botulism outbreaks. Other current disease studies by the Bureau are concerned with aspergillosis (Herman and Sladen, 1958), fowl cholera, and other diseases of waterfowl, and with trichomoniasis and fowl pox in doves.

With the increased use of chemical pesticides throughout the country and by direction of Public Law 85–582 passed in 1958, the Bureau has stepped up its research on the effects of pesticides on wildlife. One of the objectives of this research is to aid in the development of materials and application techniques that will minimize losses of birds due to the use of pesticides.

It is beyond the objective and scope of this paper to summarize the research findings or to compile a complete list of publications resulting from Bureau research on birds and related subjects. The two volumes of *Wildlife Abstracts* and 97 issues of *Wildlife Review*, which have

been published since this abstracting service for wildlife management was initiated in 1935, list most of the works by Bureau personnel during the last 25 years, including nongovernment publications. It suffices to state here that many thousands of pages of printed material based upon Bureau studies or cooperative projects have appeared on bird conservation. A large proportion of the briefer, technical articles have been published in professional journals such as *The Auk, Bird-Banding, Journal of Wildlife Management, Condor,* and *Wilson Bulletin.* Among the larger works dealing with birds are at least 19 books and eight numbers of the North American Fauna series of publications.

CONCLUSIONS

Much has been accomplished for bird conservation in the 75 years since Dr. Merriam reported for duty as Economic Ornithologist in the federal service. We can take a measure of satisfaction in knowing that we have good migratory bird conservation laws, as well as both federal and state organizations to enforce those laws. We can take pride in our system of National Wildlife Refuges and in our far-reaching Federal Aid in Wildlife Restoration program, which enables the states to develop and maintain effective programs of wildlife management and conservation. We can take satisfaction in the fact that the needs of fish and wildlife are being considered today through a Branch of River Basin Studies in developing our major river basins for power, flood control, and recreation. It is encouraging, also, to realize that our national appreciation for the values of birdlife, and, indeed, wildlife in general, has progressed to a level whereby these animal resources are regarded today as important assets on National Forests, National Grasslands, and National Parks. Last, but surely not least, we can bolster our confidence to some extent in the knowledge that we are continuing the fine example set in Merriam's time of relying on research to contribute needed new information to our store of knowledge about birdlife. This is vital if we are to do a better job of bird conservation in the future.

Gratifying as the foregoing developments and accomplishments are, it must be emphasized that we cannot afford to rest on the gains of the past. The task of maintaining these gains, and the challenge of meeting the new bird conservation problems that will arise in the future will require our best continuing efforts. It is well to realize that we are a rapidly expanding nation and that our human population may double by the turn of the century. Such expansion will bring many new problems for bird conservationists. Will we be prepared to meet and solve them?

The voice of the A.O.U. was prominent in the inauguration of bird conservation as a necessary federal activity, and the continuing active interest and concern of the A.O.U. membership in federal bird conservation affairs will help in building and sustaining the kind of programs that will be needed to meet the migratory bird conservation problems of tomorrow.

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LITERATURE CITED

ALDOUS, S. E. 1942. The White-necked Raven in relation to agriculture. Fish and Wildlife Service, Research Report 5, pp. 1–55.

BANKO, W. E. 1960. The Trumpeter Swan—its history, habits, and population in the United States. Bureau of Sport Fisheries and Wildlife, N. American Fauna No. 63, pp. 1–214.

BEAL, F. E. L. 1933. Some common birds useful to the farmer. U.S. Department of Agriculture, Farmers' Bull. No. 630, pp. 1–28.

BEAL, F. E. L. 1936. Food of some well-known birds of forest, farm, and garden. U.S. Dept. of Agriculture, Farmers' Bull. No. 506, pp. 1–33.

CAMERON, J. 1929. The Bureau of Biological Survey—its history, activities, and organization. Johns Hopkins Press. x + 339 pp.

COTTAM, C. 1939. Food habits of North American diving ducks. U.S. Dept. of Agriculture Tech. Bull. No. 643, pp. 1–139.

GEIS, A. D. 1959. Annual and shooting mortality estimates for the Canvasback. Jour. Wildlife Mgmt., **23**: 253–261.

HERMAN, C. M., and W. J. L. SLADEN. 1958. Aspergillosis in waterfowl. Trans. 23rd N.A. Wildlife Conf., pp. 187–191.

JONES, J. C. 1940. Food habits of the American Coot with notes on distribution. U.S. Dept. of the Interior, Wildlife Research Bull. 2, pp. 1–52.

JUDD, S. D. 1901. The relation of sparrows to agriculture. U.S. Dept. of Agriculture, Bull. No. 15, pp. 1–98.

JUDD, S. D. 1902. Birds of Maryland farm—a local study of economic ornithology. U.S. Dept. of Agriculture Bull. No. 17, pp. 1–116.

KALMBACH, E. R. 1920. The crow in its relation to agriculture. U.S. Dept. of Agriculture, Farmers' Bull. 1102, pp. 1–20.

KALMBACH, E. R. 1940. Economic status of the English sparrow. U.S. Dept. of Agriculture Tech. Bull. No. 711, pp. 1–66.

KALMBACH, E. R. and M. F. GUNDERSON. 1934. Western duck sickness a form of botulism. U.S. Dept. of Agriculture, Tech. Bull. No. 411, pp. 1–81.

KIEL, W. H., JR. 1959. Mourning Dove management units—a progress report. U.S. Dept. of Interior, Fish and Wildl. Serv. Special Sci. Report—Wildlife No. 42, pp. 1–24.

LINCOLN, F. C. 1935a. The migration of North American birds. U.S. Dept. of Agriculture, Circular No. 363, pp. 1–72.

LINCOLN, F. C. 1935b. The waterfowl flyways of North America. U.S. Dept. of Agriculture, Circular No. 342, pp. 1–12.

LINCOLN, F. C. 1950. Migration of birds. U.S. Dept. of Interior, Fish and Wildl. Ser., Circular 16, pp. 1–102.

MARTIN, A. C., and F. M. UHLER. 1939. Food of game ducks in the United States and Canada. U.S. Dept. of Agriculture, Tech. Bull. No. 634, pp. 1–156.

MARTIN, A. C., H. S. ZIM, and A. L. NELSON. 1951. American wildlife and plants. McGraw-Hill, ix + 500 pp.

MCATEE, W. L. 1931. Usefulness of birds on the farm. U.S. Dept. of Agriculture, Farmers' Bull. No. 1682, pp. 1–13.

MCATEE, W. L. 1939. Wildfowl food plants—their value, propagation and management. Collegiate Press, Ames, Iowa, ix + 141 pp.

METCALF, F. P. 1931. Wild duck foods of North Dakota lakes. U.S. Dept. of Agriculture, Tech. Bull. No. 221, pp. 1–71.

SPERRY, C. C. 1940. Food habits of a group of shore birds: woodcock, snipe, knot, and dowitcher. U.S. Dept. of Interior, Wildlife Research Bull. 1, iv + 37 pp.

SPERRY, C. C. 1947. Botulism control by water manipulation. Trans. 12th N.A. Wildl. Conf., pp. 228–233.

WETMORE, A. 1918. The duck sickness in Utah. U.S. Dept. of Agriculture, Bull. 672, pp. 1–26.

Branch of Wildlife Research, Bureau of Sport Fisheries and Wildlife, U.S. Fish and Wildlife Service, Department of the Interior, Washington 25, D. C.

THE BREEDING BIOLOGY OF SHOREBIRDS ON BYLOT ISLAND, NORTHWEST TERRITORIES, CANADA

WILLIAM H. DRURY, JR.

INTRODUCTION

THIS paper compares the interactions of two species of plovers usually placed in separate genera (A.O.U. *Check-list*, 1957) with two species of sandpipers usually put into the same genus (A.O.U. *Check-list*, 1957).

The 1954 Bylot Island Expedition spent from 12 June to 29 July at the mouth of the Aktineq River, at approximately latitude 73° N, longitude 79° W, in southern Bylot Island. Bylot is between the Low and High Arctic just north of Baffin Island and south of the eastern end of Devon Island. A short description of the expedition has been published by the Drurys (1955), and a lively, popular account is given in Scherman (1956). A map showing the study area and locality names appears in Scherman and in Miller (1955). Faunal details and description of the study area have been published in Van Tyne and Drury (1959).

Observations were made by William Drury, Mary Drury, and Benjamin Ferris, who concentrated on the breeding birds; and by Josselyn Van Tyne, who gathered information in daily collecting trips outside the study area. A field map (Figure 1) shows localities in our study area. A vegetation map (Figure 2) shows location of nests.

The expedition was supported by a private grant and by the New York Zoological Society. Arrangements were made through the Arctic Institute of North America. I prepared this report while on sabbatical half-year at Harvard University in 1955 and made extensive revisions while with the Massachusetts Audubon Society. Josselyn Van Tyne's illness and death prevented the preparation of a combined report and delayed the publication of this material, but we were able to report several of these conclusions at the American Ornithologists' Union meeting in Boston (Van Tyne and Drury, 1955).

I. ECOLOGY AND DISPLAYS

AMERICAN GOLDEN PLOVER

Pluvialis dominica (Müller) (Eskimo: Toódlee-hrátsuk)

We could easily differentiate the sexes because the face and underparts of the males in our area were almost solid black, whereas in the

Figure 1. Field map of the study area.

female they were mottled with gray and white, and the white areas on the sides of the chest almost met. Golden Plovers were display-flying on Bylot Island when we arrived the evening of 12 June. We saw a flock of 90 to 100 flying rapidly southeast on 15 June, and 96 on 16 June flying north.

Habitat and density. The two nests of Golden Plovers in our study area (Figure 2), the 13 pairs at Ooyarashukjooeet, and the six pairs near Oonakuktooyuk were on the general tundra vegetation of mosses (Hypnaceae), sedges (Cyperaceae, Juncaceae), grasses (*Trisetum spicatum* [L.] Richt., *Poa rigens* Hartm., and *Arctagrostis latifolia* [R. Br.] Griseb.), Avens (*Dryas integrifolia* M. Vahl), and Arctic Willow (*Salix arctica* Pall.), where mat plants alternated with small

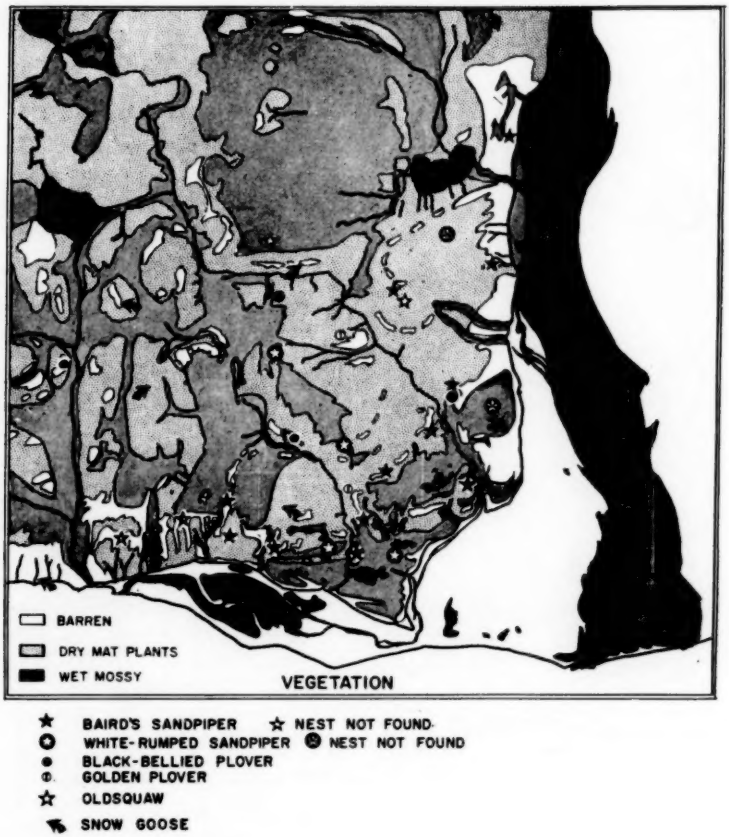

Figure 2. Vegetation and nests. The major types of vegetation in the study area are mapped. Symbols of the nest locations show the correlation of sites with vegetation.

patches of bare soil. In these places, Golden Plovers were on fine-grained soils disturbed by frost action into polygons and terracettes (Washburn, 1956). At Oonakuktooyuk, the slopes were so disturbed by slumping that the bare areas on the tops of the terracettes were larger than the mats of vegetation.

We found Golden Plovers on south-facing areas below 150 meters from which the snow disappeared early. All territories were within two miles of the coast. Seebohm and Harvie-Brown (1876) reported

this species nesting on exposed, rounded hilltops in the Petchora Valley; in western Alaska, Walkinshaw (1948) found one nest in a damp spot of tundra on a mound surrounded by sedges, another on "much higher, completely dry . . . land." Any comparison of nesting sites involving a large geographical area must allow for regional differences of vegetation. Full, accurate descriptions of vegetation are usually not available. Nearly all sites at Bylot Island were dry, in comparison with those studied by Walkinshaw in Alaska.

Territory. In display flight over Plover Plateau (Figures 1 and 3), a bird flew with hesitant flight like that of a Nighthawk *(Chordeiles minor)* or the fish flight of a Common Tern *(Sterna hirundo)*, calling *ktoódlee ktoódlee*. It flew in either direction, or in "figure 8's," from Loon Pond to Iceberg Lake. A second flight pattern overlapped with this—over Tui-Tui Tabletop west to the West Ridge. We did not see two birds in the air at once, and we saw no conflicts. Walkinshaw (1948) reports a similar flight ending with a sudden drop almost to the ground, then a quick rise to pass far out over the tundra.

At times we heard only a *kleeeee* given every 20 seconds, but when the bird came closer, we heard a fainter *tood* preceding the louder note. Displaying birds flew with their wings held largely above the horizontal. There was a slight hesitation at the highest point and a longer hesitation at the end of the downstroke (Figure 3). These flights were most frequent and longest on 12–15 June; and last recorded on 6 July. The usual times were 2100 to midnight and early in the morning.

Aggressive behavior. The parents at nest No. 2, on intrusion of a male Black-bellied Plover, took the posture described in Table 1 (Aggressive on Ground).

On 30 June at nest No. 1 the alarm cries of a pale bird brought up a dark bird, but when the dark bird (presumed male) came to within 30 meters, the "female" suddenly turned and drove him away. This may have been because he was not her mate or because she was confused and overexcited by me. As Williamson (1947) and Moynihan (1955) have suggested, the tendency to drive away the human intruder is redirected to a substitute that will flee. When attacked, the male ran away a short distance, then both birds stopped. Again she ran at him, head down and back feathers ruffled, crying *túrdileee* and *klecéar;* then flew at him with head stretched out in front, calling *eeeeeooooo-eeeeeooooo tswit-tswit, eeeeeooooo-eeeeeooooo eeeeeooooo-eeeeeooooo*, or *kloo tswit-tswit kloo*. At each cry of *tswit-tswit*, the pursuer bobbed her head vigorously. Sometimes she pursued him in a short, rapid zigzag. He flew; she caught up and glided past while he flew on; she lit and he lit near her, and they repeated the "leap-frog" performance. When

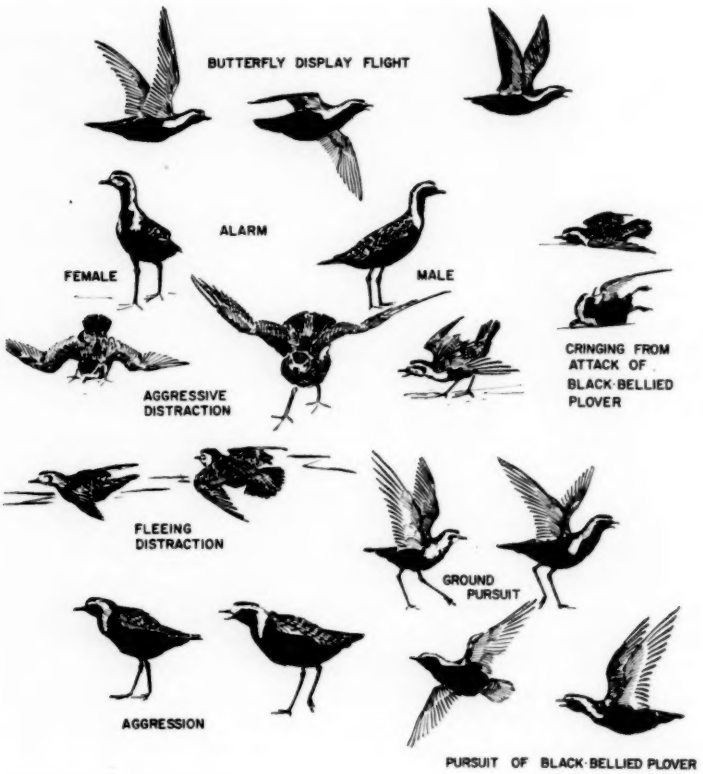

Figure 3. Golden Plover displays.

they landed, they held their wings over their backs and ran a few meters (Figure 3—ground pursuit). The colors of the axillars in the two closely related species of *Pluvialis* suggest that this posture, holding wings over the back, has "signal" function.

During a group flight over the uplands at Ooyarashukjooeet on 12 July: (1) one bird flew in a meandering course over a circumscribed area, while another repeatedly flew from behind, set its wings at the limit of the upstroke, and coasted past, calling *toodleéka-toodleéka*, bobbing its head violently; (2) two birds on one occasion and three on

another, pursued each other with rapid zigzagging, hairpin turns, steep dives, and towering climbs, swerving and spreading their tails. They spread their tails simultaneously many times during the flight, even when flying straight. They called *tsee-witwit-tsee* or *tswit tswit*. We heard these calls only when a Golden Plover was driving away another Golden Plover, a Black-bellied Plover, a Parasitic Jaeger *(Stercorarius parasiticus)*, or a Long-tailed Jaeger *(Stercorarius longicaudus)*.

These displays resemble those described for the European Golden Plover *(P. apricaria)* by D. Nethersole-Thompson (Witherby, *et al.*, 1940).

Appeasement display. On 22 June I watched a presumed female at the mouth of Golden Plover Creek. A second bird flew down from the plateau and lit about 20 meters away, then with head lowered and shoulders hunched, ran a short way toward the female with his wings raised, folded his wings and ran forward again. When he was about one meter away he cried *witwit* very rapidly, then stood with his head and neck stretched upward (Figure 3, male). The other bird remained motionless, with head raised (Figure 3, female), then took a few slow steps and pecked the ground, and took a few more steps. The new bird followed for a few moments, then they moved apart, feeding.

Nest and eggs.[1] The three Golden Plover nests that we found (mapped in Figure 2—dry mat plant areas) were in slight hollows surrounded with scattered mat plants.

From date of hatching of our earliest nest, the clutch (4) was completed between 18 and 20 June. The first egg was probably laid on 13 June. In some Golden Plover eggs there is a greenish tint to the background color in contrast to the pastel gray of the Black-bellied Plover, but our examinations in the field and in egg collections showed no reliable way of distinguishing the eggs of the two species.

Activities during incubation. At nest No. 1 the female (judged by plumage) was nearly always at the nest, and we rarely saw the male during nest-checking rounds. We have moving pictures of the dark-plumaged bird performing distraction displays, however, and know that both members of the pair stay close to the nest during incubation. Allen (1934) reported that both parents incubated at Churchill, Manitoba. Walkinshaw (1948) reported that in "Pacific" Golden Plover *(Pluvialis dominica fulva)*, both parents incubated. My experience

[1] Detailed descriptions of nests of the plovers and the sandpipers are available at the Hatheway School in South Lincoln, Massachusetts. These descriptions include elevation, location and description of site, details of the surrounding vegetation, and materials used in the scrape. They also include the daily observations, date of finding, and times of hatching.

TABLE 1

SUMMARY COMPARISON OF THE PLOVERS

Black-bellied Plover	*Golden Plover*	*Ringed Plover*
	Nesting Site	
Wind-blown, Gray Lichen-strewn areas early free of snow, exposed; on ridge or terrace with a wide view.	More protected, moss- and mat plant-grown areas commanding good view but not exposed; on slope below ridge.	Gravel pavements nearly free of vegetation, on raised beaches, sea beaches, or abandoned river bars.
	Scrape	
On bare soil surrounded by Gray Lichen; nearly smooth surface; coarse soil.	Surrounded by mat plants; irregular surface with terracettes, fine-grained soil.	Not seen.
	Displays	
	Aggressive on ground	
Head on shoulders; back feathers ruffled; wrists not seen to be lowered. (Wrists are lowered in aggressive display on migration.)	Head pulled in on shoulders; back feathers ruffled; breast feathers (especially on sides) fluffed out; wrists slightly lowered; stalks stiffly at opponent. To attack, lowered head and thrust forward, back more ruffled, and runs at intruder.	Horizontal stand, head down and forward, back feathers ruffled, tail raised and barely fanned; *tche-rick* crescendo call becoming a rattle; fast runs (glides) at opponent.
	Flee-appeasement	
Sleeking of feathers inconspicuous; head held up without raising breast.	Head and body feathers sleeked, head held high, raising breast.	Breast and head high; body feathers sleeked.
	Ground display	
Pursuit and running parallel in aggressive posture. *Kleéecar.* No head bobbing seen.	Pursuit and running parallel in aggressive posture. Call *pwit-pwit, ka-sweéeooowit;* bobbing head violently. When landing after a flying rush, holds both wings over back.	Not seen.

TABLE 1
(Continued)

	Flight display	
Single male butterfly flight at 30 meters over territory. *Koódiloó*, followed by swerving zigzag, alone or as pursuit.	Single male butterfly flight at 75 meters over territory, calling *ktoódlee*.	Butterfly flight at 3–10 meters, calling *tche-rick* crescendo.
	Paired flight display	
Not seen.	a) A rapid flight with towering and swerving. b) One sets wings as a pigeon does and glides past companion, crying *toodleéka* with head-bobbing.	Not seen.
	Alarm call	
a) *Kleeee, koódlee.* b) *Kéeku-kudléeah.*	a) *Kleéear, túrdeleéee, killik-killik.* b) *Túdlea-túdlea.*	*Churi* (short and rich), or *kleéeur.*
	Distraction display *Low intensity*	
1. At first, head-up alarm; displacement feeding. 2. Runs 10–25 meters with head lowered, stretched far forward; wings drooped; tail barely fanned and tilted to intruder; back feathers much ruffled—cries *kleee;* frequently settles with fast squirming, as if on eggs, but head along ground as if to hide; occasionally rushes in with feathers ruffled, looking white all over; displacement feeding.	1. At first (about 75–50 meters) head-up alarm; displacement feeding. 2. Runs with head up, back ruffled, tail barely fanned and tilted—cries *kleéear eeee, turdileee, tudlee-tudléea, kiwit* or *killik-killik;* when stops, stands up, may crouch, though seldom; displacement feeding. 3. Runs diagonally to the side, crouched, both wings and tail partly spread, near wing more so; when beside intruder, stops, stands, calls; displacement feeding.	1. Flies to intruder and stands very tall at about 50 meters with breast fluffed out; displacement feeding; occasionally flies at intruder (20 meters), then stands sleeked. 2. Lowers head and spreads and tilts tail to intruder; slightly spreads near wing, drags or beats it, facing away from intruder.

TABLE 1 *(Continued)*

Black-bellied Plover	*Golden Plover*	*Ringed Plover*
	High intensity	
3. Prostrate, breast on ground in a hollow; bill thrust forward, chin along ground; tail cocked and fanned; wings almost fully spread, beating spasmodically (a second between beats), primaries brushing ground noisily; feet stamping though obscured; usually faces to one side of intruder, head turned to one side; occasional hoarse *kleee.*	4. Deep bow or breast on ground, hunched, feet stamping but legs not in crouch; tail often fanned and usually barely cocked up; head pulled in; wings partly opened and spread (resembles a threatening owl), slowly beating noisily on the ground; occasionally crouching; usually faces intruder. Stands or crouches, but not seen prostrate.	3. Wriggles away over the ground, tilted on one side, beating one wing up in the air. 4. Freezes crouched, back to, in a hollow; head down, tail partly fanned and lowered, back feathers ruffled; held until 10 meters. When ignored, scolds, displacement feeds, runs closer—to start again.
	Response to pursuit	
4. Runs off, low rolling from side to side, with wings folded and slightly lowered, tail spread; head down, thrust forward, but watching intruder; back ruffled; stops in hollow and beats wings slowly; prostrate again with wings widespread. No use of wings as runs.	5. (a) Runs off crouching, with wings open and down at sides, beating and shuffling as if forelegs; looks over shoulder; breast along ground; tail canted down and partly fanned (rarely furled and cocked up); watches intruder. (b) Runs rapidly, fluttering.	5. Runs crouching, tail slightly raised and furled; wings folded, gliding over ground; then crouches again.
	Plumages	
Male has more complete spring plumage than the female.	Male has more complete spring plumage than the female.	Male has more contrasting colors in black vs. brown plumage than the female.
	Incubation	
Male incubates most of the time. Female rarely seen to incubate. Started at earliest nest 26 June. Incubation period at two nests 27 days.	Female incubates most of the time. Male rarely seen to incubate. Started at earliest nest 17–20 June.	Both sexes.
	Hatching	
22–29 July. Young brooded in scrape two nights.	15–23 July. Young brooded in scrape one night.	Fast-running, downy young—20 July.

with the European Golden Plover in Finland indicates that both sexes incubate.

Hatching and care of the young. The eggs in nest No. 1 hatched 15 and 16 July. One egg in nest No. 2 pipped 20 July, three hatched 22 July; all by 24 July. We found two young and their parents on 17 July in the marsh at the northwest corner of Plover Plateau when the young of nest No. 1 were at Loon Pond. The young stayed in the nest until all eggs hatched; then all four left, but returned to the scrape the first night, presumably to be brooded. On the following day they moved to marshy places. Both parents accompanied the young for at least two weeks. For a discussion of the plumage of juvenals, see Van Tyne and Drury (1959).

Reactions to predators. D. Nethersole-Thompson (Witherby, 1940) said that injury feigning is not common in the European Golden Plover, but we found it commonplace and conspicuous at Bylot Island as soon as clutches were complete, as did Williamson (1948). My experience with European Golden Plover in Finnish Lapland in 1958 was that they cried noisily, but did little distraction display.

For distraction display at various levels of concern see Table 1. Between distraction displays the bird ran, pecked stiffly and called *khlleeeecooo* in alarm. As it circled it often ran in closer, when it was behind us with the sun behind it. There was a complete gradation of intensity from the early alarm call at leaving the nest to the violent wing flopping.

At both nests the dark-plumaged birds (presumably males) consistently were more shy, performed less-intense distraction displays, and remained at a greater distance. After watching a pair near Oonakuktooyuk for 10 to 15 minutes on 20 July, I shot the dark-plumaged bird, and it was a male. When the bird rushed at us and threw its breast into a hollow with wings spread, it closely resembled postures illustrated by Hosking for Avocet *(Recurvirostra avosetta)* in Simmons (1955) and for Killdeer *(Charadrius vociferus)* by Deane (1944).

BLACK-BELLIED PLOVER

Pluvialis squatarola (Linnaeus). (Eskimo: Toódlee-hrátsuk)

The Eskimos called this species by the same name as the Golden Plover, although they recognized two different species. Reasons for including *squatarola* in *Pluvialis* are given below (Behavior and Systematics), and in Van Tyne and Drury (1959).

Males were in full, dark-breasted plumages; females were much less fully spring plumaged and varied in the amount and position of black

patches and speckling. The female at nest No. 3 showed no black below. We first saw this species on 17 June at camp, and never saw flocks. We heard the typical fall cry, *kećleeeoó*, first on 22 July from a bird flying south over the Aktineq.

Habitat and density. Sutton (1932) and Brandt (1943) speak of the exposed nature of the Black-bellied Plover's habitat, remarking that they nested on high, exposed ridges. Four nests and two territories near camp (Figure 2), two pairs east of the Aktineq, 10 July, three pairs at Ooyarashukjooeet, 14 July, and two territories near Oonakuktooyuk, 20 July, were all associated with the driest, most exposed ridges, river banks, or raised beaches, within a mile of the sea.

These areas were among the first to be free of snow, and were characteristically on sand or gravel scattered with cobbles and black lichens, clumps of Grass Rush (*Luzula confusa* Lindeb.) and Gray Lichen (*Stereocaulon paschale* [L.] Ach.). There was a sparse growth of mat plants (Arctic Willow, and Bell Heather, *Cassiope tetragona* [L.] D. Don), and clumps of Alpine Sweetgrass (*Hierochloe alpina* [Sw.] R. & S.), Poppy (*Papaver radicatum* Rottb.), and Purple Saxifrage (*Saxifraga oppositifolia* L.). Seebohm and Harvie-Brown (1876) report the nesting of Black-bellied Plover on peat ridges in wet marshes, and Walkinshaw (1948) reports a nest on a mound on a flat above a lake. (In western Alaska the term "flat" usually refers to a compound peat bog of great extent.)

Territory. We saw display flight and ground displays 19 and 20 June near Loon Pond. The flying bird stayed at about 30 meters above the ground, flapping slowly and hesitantly as does a butterfly (Simmons, 1953), or a Short-eared Owl *(Asio flammeus)*—(Figure 4). The displaying bird flapped more slowly and had a shorter hesitation at the top of the upstroke than a Golden Plover. It called *kehweh*, or *kúdiloó*, like its own fall cry, but with the quality of the call of a European Curlew *(Numenius arquata)*. The first and last syllables were accented, and were longer and lower than the middle syllable. At the end of the slow flight, the bird suddenly flew very fast, swerving and towering, and occasionally dashing at the ground. We have often seen diving flight, on spring migration, and it has been reported by Seebohm and Harvie-Brown (1876), Haviland (1915), and Sutton (1932). At 2330 on 3 July a Black-bellied Plover was still slowly display flying over Tui-Tui Tabletop and the Little River, calling *koódleeeoó* about once a minute.

Aggressive behavior. The Rosins (Drury and Drury, 1955) described Black-bellied Plovers on 19 June endlessly running past each other—one with head lowered, the other with head raised. This may

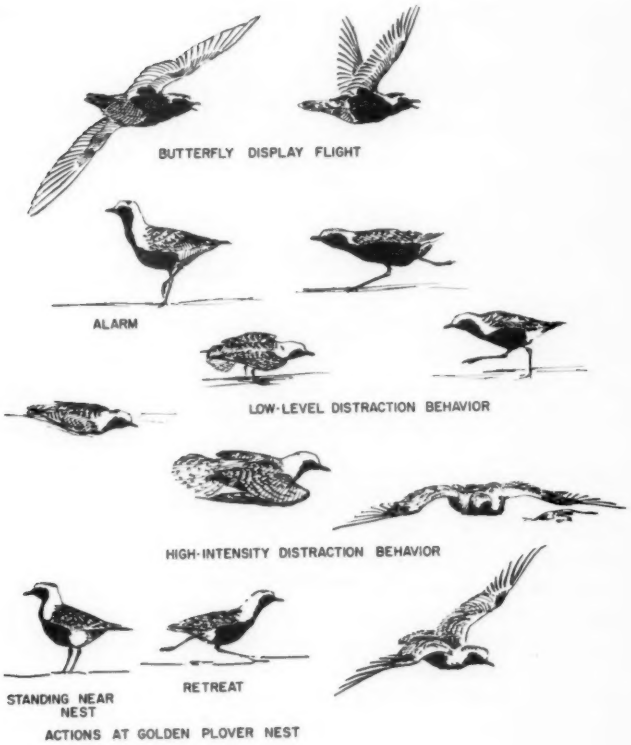

Figure 4. Black-bellied Plover displays.

be similar to behavior of Golden Plovers described by Williamson (1948). Birds at the nest "directed" similar running at an intruder, which suggests aggression (Simmons, 1955). The male at nest No. 4 briefly redirected hostility toward his mate. He ran at her with head down, calling *kleéear*. She ran to one side with head held very high (see Competition between Black-bellied Plover and Golden Plover under Ecological Interactions).

I have seen aggressive postures among birds in breeding plumage on fall migration in August in Massachusetts. At its most intense expression, when "standing off" an opponent, one bird bows deeply with head stiffly held down in line with the body, back ruffled, tail fanned and raised, breast feathers fluffed. The birds may crouch in this posi-

tion and then, standing stiffly, peck at the ground and flick pebbles or bits of weed over the shoulder. They may edge around each other, crouching and bowing, wrists partly lowered and tail canted and mostly spread; then they stop and flick pebbles again. When aggressive, migrant birds move toward an opponent, they stalk stiffly, suggesting differences from the actions the Rosins described. Much more detail is needed.

Nest and eggs. The four nests that we found (Figure 2) were all in bare areas among widely scattered patches and clumps of plants. We found a nest with three eggs on 30 June. In this and two other nests, eggs hatched 26–29 July. In another nest, eggs hatched 22–24 July, which suggests that the first egg was laid about 20 June. Clutch size was four in all nests.

Activities during incubation. At the nests studied, the male did almost all the incubating, but we saw the female near nests Nos. 1, 3, and 4 repeatedly. At nest No. 3 the female stayed in a sedgy marsh about 100 yards away and occasionally approached the nest when intruders came. On one visit after a long disturbance the male returned to incubate, but an hour later the female was on the nest. The female as well as the male incubated at nest No. 1. In 15 visits to each nest we found both birds absent two or three times for each. Shyness may have made the parent (female?) leave so early that the nest checker missed it. Pickwell (1942) called such action "casual abandonment" and suggested that it is of survival value in concealing the nest of Prairie Horned Larks *(Otocoris alpestris praticola)*.

Hatching and care of young. The last egg in nest No. 1 was laid on 1 July or early in the morning on 2 July; it hatched the night of 27 July or early on 28 July—one day after two others, and two days after the first to hatch, 26 July. Incubation period was 26 days (or almost 27 days). One egg in nest No. 2 hatched 27 days after the nest was found. Several eggs pipped two days before hatching. The eggs hatched over a two-day period, 23–24 July in nest No. 3 and 28–29 July in nest No. 2. Nest No. 4 had not hatched, but two eggs had cracked when we left on 29 July. Brandt (1943) reports an incubation period of 23 days in one instance in Alaska, but without details. Dementiev *et al.* (1951) report that the incubation period is unknown. Höhn (1957) reports the hatching of one egg 24 days after completion of the clutch on Banks Island. My experience with Killdeer suggests that the incubation period can be lengthened two days if the nest is regularly visited. The young spent one night in the scrape after all had hatched. We have no observations of parents with young away from the nest.

Reactions to humans. Black-bellied Plovers were extremely shy at

the beginning of the incubation period. I found the first nest on 30 June accidentally while studying frost features through binoculars. The male, sitting on this nest, left it as soon as we appeared, over 200 meters away, and ran very fast with head down, for 75 meters, along a frost crack. At that distance he stopped, looked up, called, and flew away. On 2 July the clutch was completed, and we saw the first distraction display—running in a crouch with the near wing lowered. The birds at nests Nos. 1, 2, and 4 would not come within 100 meters until the last week of incubation, while the male at nest No. 3 showed marked concern more than two weeks before hatching. Toward the end of the incubation period, the male left the nest when we were about 100 meters away. When the eggs pipped and cracked in nest No. 1, the parents came within two meters to display. The less-aggressive bird at all nests was markedly less full plumaged. On leaving the nest, the male usually flew to a high ridge and watched us, occasionally calling *gleee* or *keéeku-kudleéah*. The usual cry from the nest was *koodleé*. If the intruder withdrew, often he returned to the vicinity of the nest and seemed to settle on eggs. The male at nest No. 3 did this three times within 30 meters of the nest while we were waiting for him to return, and at one place spent 27 minutes in rather "disinterested" preening after seeming to have settled on a nest.

For details of the several levels of intensity of distraction behavior see Table 1. The circling bird regularly came closer when behind and against the light. Occasionally he rushed in (presumably aggressively), showing a maximum of white, holding his head down, back feathers ruffled, and tail cocked and partly spread; occasionally he spread his wings wide on this run. At nest No. 3 the female stood and flapped her wings slowly (very much like the distraction display of a Golden Plover) while the male was running in close with wings spread and head thrust forward. The pair ran together in an arc, he with head lowered, she with head raised.

Reaction to jaegers. A Black-bellied Plover dashed at a Parasitic Jaeger hovering over a loon *(Gavia stellata)* nest 30 June, flying very fast, calling *kidloóeeeoó*, and chased the jaeger up the Aktineq River. In July Black-bellied Plover males Nos. 1 and 2 drove Long-tailed Jaegers away from their nests, as Brandt (1943) has described.

RINGED PLOVER

Charadrius h. hiaticula Linnaeus (Eskimo: Koódlee-koodleéah)

The population that we studied was part of the Old World *C. h. hiaticula*. We have indicated (Van Tyne and Drury, 1959) that we

agree with Bock (1958, 1959) that the New World population is the same species as the Old World Ringed Plover. The former, however, raises the white feathers of its throat conspicuously in threat behavior on migration, while the broad breast band of the European race seems to be emphasized by that population. This needs further study.

We found this species on gravel pavements, which the prevailing east wind kept nearly free of vegetation, on a hilltop east of the Aktineq, on gravel bars at the Aktineq and at Ooyarashukjooeet, and on thinly vegetated cobbles of an old beach deeply scarred with frost cracks, 50 meters above sea level at Oonakuktooyuk. The sites agree with those reported from central Baffin Island (Wynne-Edwards, 1952), and from southern Baffin Island (Sutton and Parmelee, 1956) for *C. h. semipalmatus.*

Display flight. We saw Short-eared Owl-like flight at Ooyarashukjooeet on 14 July and at Oonakuktooyuk on 20 July when we entered a territory. Many times we heard birds in the air and on the ground calling *tché-rick tché-rick* more and more rapidly until the call became a steady rattling that ended suddenly on a descending slur. Soper (1928) and Sutton and Parmelee (1956) described this as the flight song of *C. h. semipalmatus.* Simmons (1953, 1955) pointed out that flight song may be found as low-intensity distraction or hostility displays. The call is common on fall migration when birds are threatening.

Aggressive postures. The female collected 14 July showed moderate concern and was not the bird that performed the owl-like flight or that suddenly flew in close and stood with head held high, breast fluffed out (described by Edwards *et al.*, 1947, as an aggressive display). Usually the cries of birds disturbed on their territories attracted one or two neighbors that stood and called nearby, as Mason (1947), and Sutton and Parmelee (1956) reported.

Distraction display. When running, the birds seemed to try to put themselves on the side of the intruder away from the chicks, as Ledlie and Pedler (1938) suggested for the Little Ringed Plover *(Charadrius dubius).* Simmons (1952) wrote that *semipalmatus,* in areas where there is less fear of humans, direct the distraction display to, or at right angles to, the intruder; while *hiaticula* direct it away.

WHITE-RUMPED SANDPIPER

Heteropygia fuscicollis (Vieillot) (Eskimo: Lívilivilak)

Reasons for reinstating *Heteropygia* are given below (Behavior and Systematics).

We heard no calls that resembled *lívilivilak.* Thus, the Eskimos'

name seems to be name transfer from Semipalmated *(Calidris pusillus)* and Least Sandpipers *(Calidris minutilla)*, which have such a call, and are named "livilivilak" by the Eskimos of Baffin Island, Southampton Island, and Melville Peninsula. Bylot Island, together with Arctic Bay, where Shortt and Peters (1942) collected juveniles, seems to be the northeasternmost recorded breeding of White-rumped Sandpipers.

We saw no bird of this species, until the general arrival on the afternoon of 19 June.

Habitat and density. White-rumped Sandpipers nested in the mossy hummocks in marshes, or in the mossy depressions in clumps of grass and sedge in the uplands (Figure 2—wet mossy). This habitat was under snow until about 15 June and, being protected by a snow blanket, had a uniform environment where mosses survive. At least six pairs nested in our study area (mapped on Figure 2). We saw none elsewhere except at a large creek three miles north of camp on 26 June.

Territory. Sutton (1932) described most of the actions except ground display. Displays were conspicuous on the afternoon that the species arrived. In display flight the bird flew with ordinary wingbeat to a height of 15 to 25 meters, and there changed to a shallow wingbeat like that of a Spotted Sandpiper *(Actitis macularia)*. The bird held its head up and neck stretched out, giving a song sounding like a fish reel running, or, as Sutton puts it, a typewriter carriage. Inserted into this song were two or three sequences, during which the bird violently extended and drew back its head. It called *ng-oik* six to 10 times in succession, sounding like a small pig; *ng* with head hunched in, and *oik* with head up and neck stretched (Figure 5). At the end of the display the bird set its wings above the horizontal and glided to the ground—silently, calling *zip-zip*, or giving the fish-reel song. As it landed, usually near another bird, it folded its wings, then slowly stretched the wing nearest the other bird straight over its head. The single-wing display was much less well developed than in Baird's Sandpiper and in the Purple Sandpiper *(Calidris maritima)* described by Keith (1938). On the other hand, flight displays strongly resemble that of Pectoral Sandpipers *(Heteropygia melanotos)*, as described by Witherby *et al.* (1940) and Pitelka (1959).

On 20 June we watched for about 12 minutes two birds (presumed to be males) fight in the presence of a third (presumed female). The males rushed at each other with head lowered, back feathers ruffled, but wings not spread. They flew up 15–25 cm. (6 to 10 inches) to peck and beat each other with their wings, land, and chase, sometimes chasing each other with wings spread and tail partly cocked. Finally one flew away toward camp; the other followed to the edge of Golden Plover

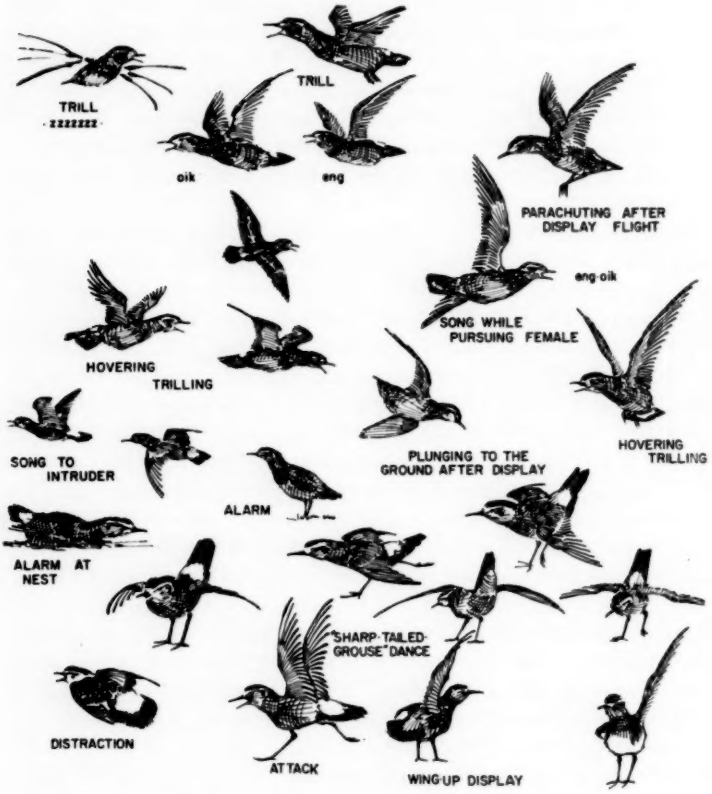

Figure 5. White-rumped Sandpiper displays.

Creek where it trilled, returned, and landed abruptly near the third. We saw and heard no song displays or territorial disputes after 30 June. We saw conflicts at two territorial borders: the marsh on the upper edge of Plover Plateau; and the flat east of the mouth of Golden Plover Creek near Loon Pond on 20 June. However, by the time the young of nest No. 4 had hatched (north of Loon Pond), territories as such had been abandoned and both young and parents trespassed unmolested.

Courtship. 1. Flight. On 21 June one bird chased another, set wings like a pigeon, and glided past, calling *ng-oik*, then banked and turned sharply on set wings (Figure 5). The pursued flew on in a semicircle

from near Loon Pond up over Kungo Hill, and the pursuer repeated the action several times. Over Kungo Hill, a bird from the West Ridge joined, and the three flew together for about 15 seconds with no conflict. Then the pursuer from Loon Pond returned, and the newcomer (a second territory) displayed on canted wings, calling like a pig, and the chase went on over Plover Plateau. A third territory and route was from the Upper Phalarope Ponds, up Golden Plover Creek to the marsh at the head of Plover Plateau. The behavior of these males, when females passed through their territories, suggests modification of courtship similar to that described by Pitelka (1959) in Pectoral Sandpipers: *i.e.*, that there is no persisting pair bond and females may nest without regard for any male's territory. We found two nests where there was one male—on the two sides of the mouth of Golden Plover Creek.

2. Ground. Ground displays resemble those of the Sharp-tailed Grouse *(Pedioecetes)*. The displaying bird gave a constant twitter—*bzzzzzzzzzzzz;* lowered his head, cocked his furled tail straight up (making the white rump conspicuous), spread his stiffly held wings to the side, dragging their tips on the ground, and rapidly stamped his feet. (We have no proof of the sex, and possibly the role of the sexes might be reversed.) In this position the displaying bird glided around after the (presumed) female, facing her (or side to her), sidling around her in a semicircle. Every now and then he raised the wing that was toward her when he was running along beside her. Several times he raised both wings (without stretching them), and tilted and spread his tail toward her. She stood with her head up and occasionally briefly raised the wing on the side toward him. She walked nervously, but stopped if she got more than two meters away. When she moved, he stopped displaying, ran up to her side, and started to sidle around her again. The action stopped suddenly, and the two birds stood idly, or the female suddenly flew off. When she flew, he pursued her in a mad dash over the marsh and hillsides, chiefly in long, straight flights, but occasionally with sharp zigzags. Displaying was interrupted repeatedly for periods of 15 minutes to an hour, during which time the birds appeared to feed.

Nest and eggs. The nests were in a mossy clump in grasslike growth. The grasslike plants growing near the nests we found included Narrow-leaved Cotton Grass (*Eriophorum angustifolium* Roth), Grass Rush, Water Sedge (*Carex aquatilis* Wahlenb., var. *stans* [Drej] Boott), or Arctic Redtop (*Arctagrostis latifolia* [R. Br.] Griseb.). The moss was usually Bog Moss (*Aulacomnium ? palustre* [Hedw.] Schwaegr.), but also other Hypneaceae such as Broom Moss (*Dicranum* sp.), Twisted Moss (*Tortella* sp.), Shining Moss (*Tomenthypnum nitens* [Schreb.]

Loeske), and Gray Moss (*Rhacomitrium ? languinosum* [Hedw.] Brid.) —(Figures 2, 5). The clutch in our earliest nest must have been completed by 25 or 26 June (Table 2); so that if eggs are laid every other day, egg laying must have started two days after the species arrived. This remarkable adaptation to arrival under rapidly changing conditions, yet exactly timed for proper breeding, should be further documented. Hinde (1951) and Nisbet (1957) have commented on the accuracy of timing of shorebird migration with the breeding cycle. Clutch size was four in all nests.

TABLE 2[1]

NEST DATA—WHITE-RUMPED SANDPIPER

Nest No.	*Date found and contents on that date*	*Location*	*First egg hatched*	*No. of young produced*
1	28 June (4 eggs)	Loon Pond	15 July	4 (1 collected)
2	3 July (4 eggs)	Lower Plover Plateau	22 July	4
3	7 July (4 eggs)	Upper Plover Plateau	20 July	4
4	12 July (4 eggs)	Phalarope Ponds	15 July	4
Brood				
5	20 July	Northwest Tui-Tui Tabletop		4
6	25 July	Upper Phalarope Ponds	May have been Nest No. 2	2+
7	25 July	Southeast Tui-Tui Tabletop		4

[1] This form of table was used by DuBois (1936, 1937); and by Sutton and Parmelee (1954, 1956, etc.) in their Baffin Island studies.

Activities during incubation. During the last two weeks of incubation, we found only one bird near the nest, and that bird reacted uniformly to intruders. Earlier, a bird loafing on the edge of the territory sang and took part in flight song on several occasions. In our nest-checking rounds we found no birds on the nest in 3 of 16 visits to nest No. 1; in 3 of 12 visits to nest No. 2; in 3 of 9 visits to nest No. 3. These suggest that birds spent 20 to 30 per cent of the time away from the eggs during the day when we made our rounds. When we waited for the parent to return, it came back fast and directly, not as if it had been frightened from the nest by our approach. Alternatively, the bird of one sex may have been frightened by us at a great distance and the other sex was returning hurriedly, having responded at meeting that

bird. Sutton's (1932) evidence from collected birds indicates that only the female incubates. We presumed that the "loafing" individual was the male. Pitelka (1959) found that male Pectoral Sandpipers take no part in incubation, and Portenko (1959) reported the same in the male Curlew Sandpiper *(Calidris ferruginea)*. When the bird returned, it entered the scrape with head down and, often, back feathers slightly ruffled. Then, with exaggerated fluffing of belly feathers, and sidewise movements that became faster and faster, then a wriggle, it pressed itself onto the eggs. In doing so it thrust its head far forward so that it rested along the ground.

Hatching and care of nestlings. One egg pipped four days before it hatched (Table 2), but usually the first egg pipped 24–18 hours before the nest was empty. The young spent the first night in the nest if they hatched in the afternoon, but did not return once they left. Two birds (equally solicitous) accompanied the young from nest No. 4 into the marshes around Loon Pond on 17 July. But in four other cases we saw only one parent with a brood of four, as did Sutton (1932). When alarmed, the young ran very fast and even swam well, but they returned to shore at the first opportunity. At nest No. 3 two birds fluttered to within three feet of our faces in "frantic" distraction, 11 days before the eggs hatched.

Reactions to intruders. The incubating bird was very tame; she sat until the intruder was within two or three meters. Once she had been put off the nest, she ran around nervously and occasionally stopped and pecked at the ground in a stiff, mechanical way unlike her deep probing when feeding. When with young, White-rumps, like Baird's, began to display when the intruder was as much as 75 meters away, but their concern did not reach the maximum shown at the nest until the intruder was at a similar distance (5 meters) from the young. The distraction display involved no fluttering unless a young one was captured and held. We saw no wing-up displays in distraction behavior.

Feeding behavior. Unlike the Baird's Sandpiper, which fed by picking from the surface in dry places, White-rumped Sandpipers fed by probing deeply in moss and wet vegetation. They usually made two or three quick probes (from half to the full bill length), then ran several inches and repeated. The young fed in thick, soft, wet mosses, probing deeply like their parents.

Dr. George W. Byers identified the stomach contents of two adults:

1. Three larvae of cranefly (Fam. Tipulidae, Gen. *Tipula*); 19 larvae of cranefly (Fam. Tipulidae, Subfam. Limoniinae); 3 spiders; 1 adult cranefly (Fam. Tipulidae, Gen. *Tipula*)—wing only.

2. One beetle larva (Fam. Carabidae); 41 cranefly larvae (Fam. Tipulidae, Subfam. Limoniinae); miscellaneous fragments of moss.

Presumably all of the larvae were secured by probing.

BAIRD'S SANDPIPER

Calidris bairdii (Coues) (Eskimo: Toóee-toóee or twee-twee)

Reasons for including *bairdii* in *Calidris* are given below (Behavior and Systematics).

The actions of this species are very similar to those of the Purple Sandpipers studied in Spitzbergen (Keith, 1938), and except for male incubation, to those of the Curlew Sandpipers studied by Portenko (1959).

Habitat and density. The 28 territories of Baird's Sandpipers that we found in and around our study area were on barren, exposed ridges, terrace banks, and raised beaches covered sparsely with mat plants and large areas of bare soil (Figure 2—barren). They were the first places free of snow. They were clustered in a crescent-shaped area on the east- and south-facing slopes from just north of Iceberg Lake to the south end of West Ridge, rather than spread over the uplands. Steep slope or exposure to the prevailing east wind was correlated with dryness, barrenness, and early disappearance of the snow, all of which attracted Baird's Sandpipers. We found only two territories at Ooyarashukjooeet. The vegetation was considerably further advanced there than at camp, and there was a much smaller area of exposed sites suitable for Baird's.

Territory. The displaying bird flew up from the ground in regular flight to a height of about 10 meters, then continued on with (1) a slow wingbeat; (2) wings set at a wide angle above its back; or (3) a quivering and shallow wingbeat (Figure 6). The slow beat or quivering beat alternated with periods of sailing on set wings, and the bird ended the flight by coasting on set wings. Birds gave their flight song in any one of the three unusual types of flight, but most frequently while gliding. Before flying and after landing, the displaying bird usually repeatedly gave long-drawn-out, slurred, hoarse *toóowee-toóowee* calls. The second syllable is higher and shorter than the first. We recorded flight songs as: (1) *drrdrrrr zzzzzzzzzzzz;* (2) increasingly rapid crescendo *dreedree-dreedreedreedree* trill, ending in *dreedree-dreedreedree-dreedree.* At the end of the song the wheezy *túwee-túwee* call came in threes now and then. It had a harsh quality in territorial

disputes. As the displaying bird landed, it held one wing fully stretched straight over its head, and ran along the ground for about one meter (Figure 6). Occasionally it opened the other wing partly, but did not spread it, or spread both wings fully over its back. Sometimes it ran with one wing spread high over its back, then folded the wing, ran on, and spread and stretched the wing again. The raised and stretched wing was almost always the one toward the other bird. Sometimes the bird sang the trill on the ground, running or standing up very straight.

The female at nest No. 3 crouched, stretched her head forward, and called *coi-it* (Figure 6) when the male lighted from a song flight and ran with wings stretched above his calling *drrrrrr*.

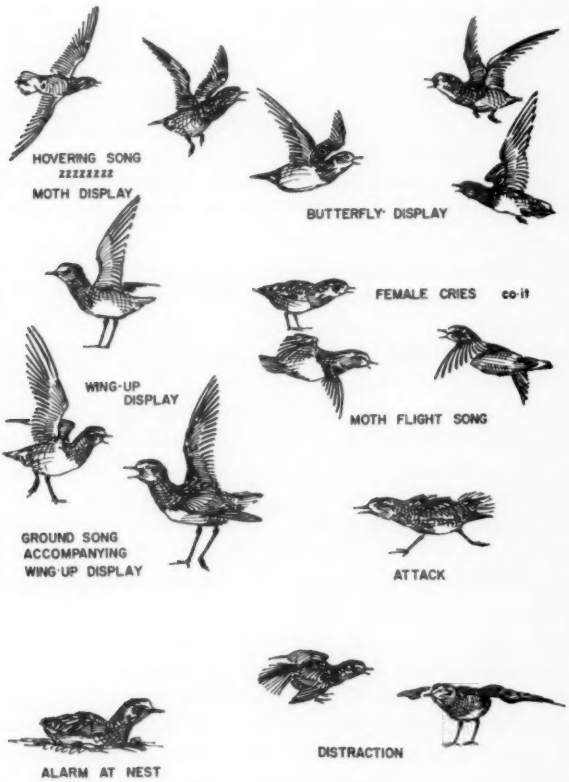

Figure 6. Baird's Sandpiper displays.

An aggressive bird rushed at another with head down, bill thrust forward, and back feathers conspicuously ruffled. Most action on the ground consisted of running along with head lowered, wings barely spread, tail spread and cocked up a little (Figure 6). When two displaying birds came together, they used the wing or wings-up display (Figure 6) and kept up a continual whining cry, *dree-dree* or *túi-túi* or rarely *drree-dree-dree*.

From 15–20 June, during the time of the most vigorous and continual displaying, eight to 10 Baird's Sandpipers fed together on the wet, sedgy, recently exposed crowns of the Bluffs west of camp. As the snow left, these groups dissipated. Occasionally they showed hostility, and sang, but we saw no prolonged disputes. These birds were presumably new arrivals that were not yet territorial. We found neither nests nor parents in that area later. Keith reported (1938) that Purple Sandpipers had common feeding grounds. Other than this suggestion of one, which soon dissipated, we found none.

Baird's Sandpipers were singing in the evening of 12 June and continued to sing, especially in the evenings and mornings through egg laying; then singing decreased sharply as incubation started 23 June. We heard songs sporadically until 29 June and again for several days after 5 July, when the first young had hatched, both as part of display to an intruder and in the morning and evening, when we were not intruding. The actions at that time were the same as those during early territorial activities.

Courtship. On 17 June, on a wet, bare, stony area on the edge of the snow, we watched a pair of Baird's Sandpipers in vigorous display for about 20 minutes. At first the male made several twittering and trilling song flights along the edge and out over the snow, singing both while he flew and while he glided. He spread one wing high over his head, underside toward the female, immediately after he landed and repeatedly afterward. Most of the time one bird crouched with head stretched toward the other, which stood erect and still. He ruffled his back feathers and flew at the other, and the two fluttered up like game cocks, equally aggressively. After a flurry of fighting, both crouched, facing each other, with heads down and forward. Next the male flew at the female and pounced on her back while she stood still. He stood on her back about 15 to 20 seconds, pulling out of her crown some feathers that we could see float away in the wind. She stretched her head forward and spread her tail while they copulated; occasionally she stretched one wing as if to keep balance. He got off, and stood stiffly with breast and head raised while she stayed crouched. She lowered her head and started to run, at which he pounced, pecked at

her head, and they copulated again. This happened three times; then she flew about 40 meters down the edge of the snow bank and he did not follow. Without 8X binoculars at 20 meters we would have thought this was a fight.

Nest and eggs. Nearly all the nests were associated with a low hummock. The typical area consisted of coarse pebbles and black, dead mosses, over which were scattered clumps of Gray Lichen, foliose and fruticose lichens (*Cetrarias*, especially *cucullata* [Bell.] Ach. and *Parmelias, Thamnolia vermicularis* [Sw.] Ach., *Alectoria nigricans* [Ach.] Nyl., and *A. ochroleuca* [Ehrh.] Nyl.), tufts of Grass Rush, Arctic Bluegrass (*Poa rigens* Hartm.), Poppies, Purple Saxifrage, Bell Heather, and Arctic Willow. Sites were often marked with frost cracks, where mosses, sedges, and mat plants (Avens, Bell Heather, and Arctic Willow) were more conspicuous in the low places. The earliest nests—Nos. 1, 5, 6, and 11—were placed on especially wind-blown and south-facing areas. We concluded that nests Nos. 2 and 6 were displaced by our making camp on the beaches where the Baird's Sandpipers were trilling on 13 June; but incubation must have started in nest No. 6 the day after we arrived (hatched 3 July). On 19 June, the first day of incubation, we watched the bird on nest No. 2 (Table 3) while it sat and added to the nest. It reached out to the front and sides, picked up sprigs of moss, Grass Rush, or Bell Heather and, sweeping its head down and backward as if brushing its breast feathers, carried the sprig back to the fold of the wing or all the way back to the base of the tail and beyond to drop it. Birds at nests No. 2 and 3 (before the clutch was complete) spent as much as half an hour on the nest—"building," frequently leaving and returning. The bird at nest No. 3 used Arctic Willow leaves. At nest No. 3 and nest No. 2, an egg was laid every other day. The earliest egg in our study area was probably laid 6 June (nest No. 6). The last egg in our study area, in nest No. 14, was laid on 28 June. Clutch size in all nests was four. For data on nests see Table 3.

Activities during incubation. At 10 nests we found a bird incubating at nearly every visit, but at two we found the parent missing relatively frequently. Several times during incubation we saw both parents at a nest; and we noticed a marked day-to-day difference in the aggressiveness of the incubating birds (see below—Reactions to Intruders). The less-solicitous parent was at the nest on approximately 20 per cent of our daytime nest-checking rounds at the 10 nests mentioned. The more-solicitous parent taken with young on 21 July was a male. When the bird ran in and settled on the nest, it usually first put its bill down among the eggs (not seeming to arrange them), and then vigorously

TABLE 3

NEST DATA—BAIRD'S SANDPIPER

Nest No.	*Date found and contents on that date*	*First egg hatched*	*No. of young produced*
1	16 June (4 eggs)	7 July	4
2	18 June (3 eggs)	10 July	4
3	17 June (2 eggs) [1]	—	–
4	22 June (4 eggs)	11 July	4 (no egg left)
5	26 June (4 eggs)	7 July	4 "
6	26 June (4 eggs)	3 July	3 "
7	28 June (4 eggs)	13 or 14 July	? "
8	30 June (4 eggs)	8 July	3 "
9	3 July (4 eggs)	12 July	4 "
10	3 July (4 eggs)	(not revisited)	
11	5 July (4 young)	4 or 5 July	4
12	5 July (4 eggs)	19 July	3 (1 did not hatch; left in scrape)

[1] Clutch size four in all 12 nests. Nest No. 3 destroyed by a dog.

shuffled from side to side and squirmed more and more rapidly down onto the eggs. It held its head in on its shoulders and did not thrust its head as far down and forward as did the White-rump. Incubation period at nest No. 2 (found before completion of the clutch) was 21 days. This seems to have been unrecorded previously.

Hatching and care of nestlings. Eggs hatched between 3 and 19 July, but the eggs of seven nests hatched between 7 and 13 July. All but one egg pipped the day before hatching; that egg pipped two days before hatching. In several nests one, two, or three eggs hatched in one day; and in every case the young left the nest the following day. We have no indication that the young returned to the nest after the last egg hatched. After hatching, the young often stayed several days in the vicinity of the nest, accompanied by both parents, and then moved to wind-blown, well-drained soils of frost-patterned areas and old beaches, or to muddy pond shores thinly scattered with sedges. The parents leading young gave a new alarm call—*drrrreeee* or *drrrreeeet*—not so low as the call note on migration, nor so mellow as the *túi-túi*. The young were slow and clumsy for three days after hatching. Either parent's song or the *drrreee* alarm made the young "freeze" the first day and for at least two weeks after hatching. We saw no pooling of young into flocks, but when young were disturbed, parents from nearby broods showed alarm and sometimes joined in distraction.

Reaction to intruders. Until the clutch was complete, parents showed little concern at the nest. With the start of incubation, the parents became solicitous, sat very close and, when disturbed, fluttered at an

intruder and performed distraction displays. The birds were markedly more solicitous in cold weather than in warm. The parents were secretive and seemed anxious to get the intruder away and then get back to the nest. Some birds returned to the nest if we sat down, as close as two to three meters. When we left they followed some 40 meters, calling; then, with head down and feathers smoothed, they ran back to the nest, stopping two or three times to look and call. In comparison with White-rumped Sandpipers, Baird's left the nest more readily, which made Baird's nests much easier to find.

Rarely, calls of *túi-túi* at the nest attracted a second bird, which stood in the background, calling occasionally. We saw no aggressive behavior toward the second bird. One parent at nest No. 4 left before we were 75 meters away, and did not return until we were 50 meters or more away. The other parent let the observer get within 20 meters without an outcry; then flew at him. In contrast, both parents at nests Nos. 6 and 7 were much wilder.

When the eggs were pipping and hatching, and when parents were escorting young, aggressiveness and distance at which they started attention getting (advertising display) increased markedly (to as much as 300 meters), and several neighbors entered the territory of a bird that was displaying. The adults made themselves conspicuous as if to keep the eyes of the intruder up and away from the young. When we got in among the young and they broke out of hiding, the parents quickly flew toward us and started creeping over the ground, flapping both wings, and crying *péew, péew*. There was a call that made the young break out of hiding and run to the parents, but I do not distinguish it in my notes. On 5 and 21 July parents sang in the air before performing vigorous distraction display, and again when we had moved off about 60 meters.

Feeding behavior. The dry surfaces of Baird's habitat were suitable for their technique of picking food off the surface.

The stomach contents of three adults were identified for us by Dr. George W. Byers:

1. Fragments of two beetles of same species (Fam. Carabidae); one spider; one small crustacean (leg only); one beetle larva (Fam. Carabidae); and miscellaneous plant fragments, including moss leaves and stems.

2. One fungus gnat (Fam. Mycetophilidae—wing only); three beetles of two species (both Fam. Carabidae); one adult cranefly, male (Fam. Tipulidae, Gen. *Tipula*).

TABLE 4

SUMMARY COMPARISON OF THE SANDPIPERS

White-rumped Sandpiper (Heteropygia)	*Baird's Sandpiper (Calidris)*
Nesting Site	
Well-vegetated sites among clumps in carpet of vegetation, in a moss base. Nest in clump of vegetation, on moss and plant foundation.	Wind-blown, lichen-strewn, early snow-free areas, with many bare patches. Nest on bare soil; scrape made in natural depression.
Excitement	
Raises head and sleeks plumage before flight display.	Raises head and sleeks plumage before flight display.
Aggression	
(a) Head thrust forward, back feathers ruffled, wings spread to sides, tail slightly cocked; crouching run. (b) At the end of "Sharp-tailed dance," head is raised and near wing often stretched over the head.	(a) Head thrust forward, back feathers ruffled, wings spread at the sides, tail partly fanned; crouching run. (b) Runs in front with head raised and near wing stretched over back showing under wing.
Appeasement	
Stands with head raised.	Stands with head raised.
Action of Companion during Display	
During "Sharp-tailed dance," several times raised head and then near wing.	At end of song flight, crouched, thrust head forward and called *co-it*. Both actions similar in ground displays.
Alarm Call—Advertisement	
None heard.	*Toówee-toówee.*
Courtship Display	
Ground display	
Varied and ritualized. (a) Runs to companion in aggressive posture or (b) Performs dance with wings stiffly spread, tail cocked straight up and furled, head thrust forward, calling *hzzzzzip*. (c) Stands before companion with tilted tail and raised wings.	Similar to aggression. (a) Runs to companion in aggressive posture or (b) At end of flight display, stops and stretches near wing up, occasionally calls *toówee-toówee* or trills as in flight song.

TABLE 4

(Continued)

White-rumped Sandpiper (Heteropygia)	*Baird's Sandpiper (Calidris)*
Display flight	
Flies up to about 15–25 meters where hovers or sails, calling: (a) Trill like a fish reel, sometimes ends with *zip-zip* call as floats down. (b) Call of *ng-oik*, bobbing head, then sails down on set wings. Display flight occasionally given with two or three birds in the air, seemingly both male and female; one did not posture in flight. Flight sweeping over large area.	Flies up to about 15 meters where hovers or sails, calling a rapidly repeated alarm or trill. Display flight only seen to be given by a single bird. Flight localized over small territory.
Flight song	
Clearly differentiated from ground song, and of two types: "small pig" and "fish reel." Decreased with start of incubation; last heard 30 June.	Given on the ground and in air: *toówee-toówee*, rapidly repeated; grades into trill. Decreased sharply with start of incubation; reappeared after young hatched.
Distraction Display	
Aggression	
(a) Flight songs of both types given at start of incubation period. (b) Stands with head raised, feathers sleeked and silent; runs rapidly, crouching, head thrust down and forward, back feathers ruffled, wings usually barely spread, tail fanned and tilted, squeaking and twittering constantly, occasionally crouching in a depression. (c) Flutters into intruder's face, squeaking and twittering. Sat close using concealment.	(a) Flight song at start and end of incubation period. (b) Stands with head raised, feathers sleeked, calling *toówee-toówee;* runs rapidly with head thrust forward, back feathers ruffled, wings partly to almost fully spread (more widely spread than by White-rump), and head held out stiffly, tail fanned and held out tilted; stops to cry *toówee-toówee*, or twitters (low grating *peeew-peeew*) while running. Comes closer (2–4 meters) when behind observer. (c) Flutters at intruder's face, and when alighting stretches one wing high over back, and may present one wing, in a posture similar to the one-wing display. Showed aggressive actions at greater distance, presumably as demonstration display.

TABLE 4

(Continued)

White-rumped Sandpiper (Heteropygia)	*Baird's Sandpiper (Calidris)*
Leading away	
Runs along in crouch, about 4 meters from intruder, wings held at the sides or tips across rump, partly open; tail fanned and tilted down, head thrust forward, squeaking; zigzags and starts and stops. If ignored, (b) and (c) above. Displacement feeding. Occasionally crouched briefly in hollow with head forward as if onto eggs. Leads about 10 meters from nest, then runs around to the side, back to the nest, with short nervous runs. Leading away is a clearly expressed action.	Runs in crouch, at an angle to intruder, wings partly open and lowered, the near wing dragged, tail occasionally fanned and tilted, head thrust forward; stops and raises head to cry *toówee-toówee*, starts and stops. Leads about 10 meters from nest. Leading away is much less well developed.
At Nest	
Clutches completed 25 June–2 July. Only one sex seems to incubate; in at least one case, both parents accompanied young; in four others, only one parent was seen with young. Concern at the nest increased just before and after young hatched.	Clutches completed 12–28 June. Both sexes seem to incubate and show concern; both sexes accompany young. Concern at the nest greatly increased just before and after young hatched.
Feeding	
Feeds by deep probing; stomach contents were larvae.	Feeds on the surface; stomach contents were adult and flying insects.
Territories	
Six nests in one square mile of our study area; arrived after the snow had left the lowlands—19 June. Territories large and complex; two nests 35 meters apart suggests polygamy.	Twenty-five territories in one square mile of our study area; were on territory when we arrived. Territories averaged 50 meters across, simply organized.
Young	
Hatched 15–22 July. Strongly buffy below.	Hatched 3–19 July. Grayish-white below.
Eggs	
Greenish-brown background color with darker spots and splotches. Females 1 and 4 laid two days after arrival.	Tan to chocolate-brown background color with darker spots and splotches. Incubation period 21 days.
Calls	
Mouselike squeak. "Fish reel." "Small pig" *ng-oik*.	*Dreeet* or *toówee-toówee*. Trill.

3. Two beetles of same species (Fam. Carabidae); two muscoid flies (probably Fam. Anthomyiidae); one adult cranefly, male (Fam. Tipulidae, Subfam. Limoniinae, *Limnophila* sp.); many cranefly eggs and leg segments (Fam. Tipulidae, Gen. *Tipula*); and many segments of legs from a slender-legged arthropod, perhaps a phalangid.

All of these animals could have been picked from the surface.

Migrants. Nonbreeding birds gave the *túi-túi* calls, but we heard the hoarse *drrrreeeet* of birds on migration first on 30 June. We saw the first flock 7 July; five on 11 July; then 16, seven, and five on the walk to Oonakuktooyuk on 20 July.

SANDERLING

Calidris alba (Pallas) (Eskimo: Idlouk and his family had no name for this species)

The reasons for including *alba* in *Calidris* are given below (Behavior and Systematics).

We saw one bird in distraction display on the dry uplands near Oonakuktooyuk. It ran with head low and neck thrust forward, calling *drreeet* or *tweeet, tweeet,* bobbing occasionally like a Spotted Sandpiper. Then it flew, alternating periods of ordinary flight with periods of rapid, shallow wingbeats, again like a Spotted Sandpiper.

The vegetation of the site was like that described for the nesting of this species in Greenland (Salomonsen, 1950–1951), streaked with alternate lines of vegetation (mosses, Avens, Arctic Willow, and some sedges) and almost barren soil, so regular as to seem ploughed.

II. BEHAVIOR AND SYSTEMATICS

Heinroth (1911), Lorenz (*e.g.*, 1941), and Mayr (1942 and 1958) have emphasized the importance of behavior in systematics. In this paper an attempt is made to use behavior to help define genera of plovers and sandpipers.

Our observations indicate that the courtship displays of the plovers (Ringed, Golden, and Black-bellied) contained similar elements, while the displays of the sandpipers were varied. The actions of the Baird's Sandpiper were simple and generalized. The similarity of actions (rushing, displaying of wings, and fluttering) that preceded copulation, to those seen in aggressive situations and in the presence of a human intruder, suggests that ritualization has not advanced very far, either to rigidity of the individual actions or to separation into several dif-

ferent actions. However, the song flight and dance of the White-rumped Sandpiper do not grade into any of its other activities, and thus are more "derived" or "less probable," as Lorenz (1935) says. On this purely behavioral basis, the sandpipers are less closely related than the plovers. Yet nearly all students place the White-rumped and Baird's sandpipers in the same genus, while putting each of the three plovers in a separate genus. This may only show the danger of making comparisons between subfamilies, based on one taxonomic character (behavior in this case).

Plovers. Displays, nesting sites, eggs, nestling and adult plumages, and skeletal features show that Golden Plover and Black-bellied Plover (Table 1) are very closely related and, in fact, do not justify separate generic status (Van Tyne and Drury, 1955 and 1959). Although we found the behavior of these two species similar, many behavior characteristics are uniform for all the plovers, and to use these as the only basis of classification would produce results as unsatisfactory as has the use of only morphological features. Lowe (1922) pointed out a morphological separation: presence of rudimentary hind toe and two cervicodorsal vertebrae with free ribs in the Black-bellied Plover, in contrast to lack of rudimentary hind toe and presence of three cervicodorsal vertebrae with free ribs in the Golden Plover. Lowe also listed nestling plumage and features of the osteology of the skull. We found the presence of the white collar—uninterrupted in the Black-bellied Plover and interrupted in the Golden Plover—but this is not without exception (see photograph in Van Tyne and Drury, 1959).

The differences in the skull, described by Lowe as conspicuous, are dictated by the habitats of the two species, as Ernst Mayr suggested to me in 1954: the Black-bellied Plover is marine and the Golden Plover largely fresh water in the nonbreeding season. Nasal glands, correlated with the marine habitat, have by their size and pressure suppressed the formation of bones and modified the region at the base of the bill, complicating embryological processes and degree of ossification in the Black-bellied Plover. Bock (1958) discusses this problem in detail, especially the structure of the skulls, and reviews the confused history of the classification of plovers based on (1) functional characters (plumage color and skulls), and (2) the presence or absence of a hind toe. The last character comes and goes without relation to other taxonomic features. Mayr (1945) and Delacour (1951) show the superficiality of the hind toe as a generic character, both in plovers and in sandpipers.

Fänge, Schmidt-Nielsen, and Osaki (1958) and Schmidt-Nielsen (1959) show that the nasal glands have a salt-excreting function in species that drink salt water. This explains the taxonomic distribution

of these glands according to species habitat and why they are so important that skull modifications appear to accommodate them. Features directly selected by habitat are not of generic value.

The ground displays, especially of aggression (Table 1), appear indistinguishable between Golden and Black-bellied plovers, but differ in detail from those of the *Charadrius* plovers that I have seen in Killdeer, Semipalmated Plover, and Piping Plover *(Charadrius melodus)* and that Edwards *et al.* (1947), Laven (1940), and Mason (1947) have described for Ringed Plover; Ledlie and Pedler (1938), Dathe (1953), and Simmons (1953) for the Little Ringed Plover; and Simmons (1953) for the Kentish Plover *(Charadrius alexandrinus): e.g.,* (1) the raising of wings (correlated with colored axillars) in aggressive situations appears in the *Pluvialis* plovers, not in *Charadrius;* (2) the ruffling of back feathers and lowering of head (correlated with brightly patterned back) in aggressive situations is emphasized by *Pluvialis* plovers, while *Charadrius* plovers emphasize the throat and breast (correlated with contrasting dark and white rings) and the fanned tail. Furthermore, (3) head-bobbing displacement activity (raising head, neck, and forward end of the body while lowering the tail) is absent in *Pluvialis* plovers, and universally present in *Charadrius* plovers.

In distraction display, the two *Pluvialis* species seem to differ, but actually the differences are in degree only. Golden Plovers stood up and faced the intruder and approached directly. When running away, Golden Plovers did not crouch as low as the Black-bellied, nor did they throw themselves into a depression. Their more upright posture in running and beating wings created the illusion of a four-footed animal —"the rodent run." Black-bellied Plovers spread their wings more fully, thrust their heads down and forward, and crouched lower; they approached the intruder diagonally and stood at an angle. Both male and female Golden Plovers distracted, whereas only male Black-bellied Plovers did. Actually the distraction by the female Black-bellied Plover at nest No. 4 was similar to that of the Golden Plover. It will be important for comparison to have more details of the distraction displays of female Black-bellied Plovers and male Golden Plovers from other areas in order to see whether there is geographical variation and to see whether the differences that we observed are species specific or sexual. In these displays, both of the *Pluvialis* plovers use their wings in unison.

In contrast, the distraction display of *Charadrius* plovers (*e.g.*, Ringed Plover, Little Ringed Plover, Kentish Plover [described by: Armstrong (1952), Dathe (1953), Edwards *et al.* (1947), England *et al.* (1944), Ledlie and Pedler (1938), Mitchell (1935), Simmons

(1952, 1955), Sutton and Parmelee (1955), and Williamson (1947)], Killdeer and Piping Plover) are alike in those features that differ from the display of the *Pluvialis* plovers: *e.g.*, wriggling along the ground, leaning on one side and waving one or both wings in an uncoordinated way (broken wing act)—see illustrations of Killdeer (Deane, 1944) and Little Ringed Plover (Dathe, 1953; Simmons, 1955). In the *Charadrius* group, one wing seems to wave independently of the other. Ringed Plovers, Little Ringed Plovers, and Killdeer may turn on an intruder and approach with wings raised and spread (see illustrations in Simmons, 1955, which also show a Kentish Plover sprawled in a posture very like that of a Black-bellied Plover). The tail is fanned and quivered in *Charadrius*, and I have not seen the tail cocked up in this context. Both Black-bellied and Golden plovers may tilt and cock their tails when bowing before an intruder. We never saw *hiaticula* run with head lowered and back feathers ruffled as in Black-bellied and Golden plovers. They ran either with heads pulled in onto their shoulders (crouch run, Simmons, 1955) or with head raised and body feathers sleeked, as Golden Plovers did or Black-bellied Plovers did when "ridden off" by Goldens. When *Charadrius* plovers crouch, they seem to try to hide; when *Pluvialis* plovers crouch, they "pretend" to settle on a nest.

Sandpipers. The relationships within the sandpipers are more complex. Skins show that the young of Baird's and White-rumped sandpipers are similar to the other species of *"Erolia,"* to which the young of *Calidris (Ereunetes) pusilla* are also very similar. This led Van Tyne to agree with Witherby *et al.* (1940) that *pusilla* be included in the same genus with *bairdii*, *alpina*, and *minutilla*. The behavior of these species, as described by various authors, agrees. Many fragmental and some fairly complete descriptions are available—*e.g.*, quotations in translations of Birula and Suschkin in Pleske (1928), Brandt (1943), Brown (1938), Haviland (1915 and 1916), Keith (1938), Portenko (1959), and Sutton (1932). In aerial song, aggressive action, and distraction behavior, Knot *(Calidris canutus)*, Sanderling *("Crocethia" alba)*, Dunlin *(alpina)*, Purple Sandpiper *(maritima)*, Semipalmated Sandpiper *(pusilla)*, Western Sandpiper *(mauri)*, Least Sandpiper *(minutilla)*, Temminck's Stint *(temminckii)*, and Curlew Sandpiper *(ferruginea)* are similar in noncomplex actions, little ritualized from hostility postures. Their trilling song is given while hovering or in butterflylike flight. The song grades into a characteristic scold note. In fact, behavior indicates that Knot and Sanderling (both using wing-up threat action—Birula in Pleske, 1928) are closer to most of the members of *Calidris* than are *fuscicollis* and *melanotos*. The Knot's

song departs from the usual trill to a call *kou-hi*, not unlike a Baird's *toóoowee*. According to Sutton (1932) *fuscicollis* resembles *melanotos* in the presence of throat or pectoral sacs. The reproductive behavior of these two: flight song, "sharp-tailed grouse" display and failure of the male to take part in incubation suggest that *melanotos* and *fuscicollis* are at a different level of ritualization from that of the rest. The male Curlew Sandpiper, otherwise closely resembling the other *Calidris*, is reported by Haviland (1915) and Portenko (1959) to take no part in incubation. The spring plumage changes in Knot, Curlew Sandpiper, Sanderling, and Dunlin form a series with the Least and Semipalmated Sandpiper and Stint type of spring plumage.

The feeding habits do not clarify the classification. The two major techniques: (1) quivering, probing action characteristic of *fuscicollis* and (2) a stabbing peck—*bairdii*—cut across the taxonomic features. Earlier authors (Hartert, 1912–1921, and Witherby *et al.*, 1940) included all these species in *Calidris* (excluding *alba*). Mayr (Delacour and Mayr, 1945) included *alba* in *Calidris*, and I agree. The place of the Stilt Sandpiper *(Micropalama himantopus)* needs clarification by behavior study.

If any species are taken out of the genus *Calidris*, *fuscicollis* and *melanotos* should be the first. Pitelka suggests relationship of these to the Ruff *(Philomachus pugnax)*. The members of *Calidris (s.l.)* are sufficiently different from *melanotos* to justify its separation even as a monotypic genus. Now the questions arise whether *fuscicollis* (1) lies outside the extremes of variation represented by the other *Calidris (s.l.)*; (2) is different enough to justify a monotypic genus; (3) is close enough to *melanotos* to justify inclusion with it; (4) is closer to the other peep that have a white rump and decurved bill (*ferruginea* males do not incubate; even *himantopus* shows sexual size differences that are suggestive). Present knowledge suggests that *fuscicollis* behavior is beyond the limits of variation known within the rest of *Calidris (s.l.)* and has moved in the direction of *melanotos* although not as far. Because of this, I suggest reinstating Coues' (1861) genus *Heteropygia*, of which *fuscicollis* is the type and about which there is no nomenclatural doubt. Portenko (1959) retains *Heteropygia* for *melanotus*. Species included in this genus by Sharpe (1899) are *melanotos ("maculata")*, *fuscicollis ("Bonapartei")*, and *acuminata;* and, in addition, *bairdii*. My studies exclude *bairdii* from the genus *Heteropygia*, as here, and show its relation to *Calidris*.

III. ECOLOGICAL INTERACTIONS OF CLOSELY RELATED SPECIES

What mechanisms in these six shorebirds allow sympatry without interbreeding or ecological interference (competition)? Darwin (1859) established that closely related species tend to compete for habitat and food necessities. Recently several studies (Gibb, 1954; Hartley, 1953; MacArthur, 1958) have examined the segregation of habitat or food that prevents direct competition between closely related species. Shorebirds are especially favorable subjects for this type of study. On migration they might be able to take advantage of what Lack (1954) calls a superabundant food supply, but actually we can assume that they do not because of observably different feeding techniques. Our studies of shorebirds on Bylot Island show that these species are subject to the classic rules of ecological competition and segregation.

Interaction of plovers. We found habitat segregation between Golden and Black-bellied plovers, but the segregation was not clear nor did it seem effective, because we also found conflict between the two. Armstrong (1952) described conflict between Little Ringed and Ringed plovers where these two largely allopatric species overlap as a result of recent changes in range. The two *Pluvialis* plovers survive sympatrically here, but over most of North America their breeding ranges do not overlap. Because we should expect that there will be geographic variation in the mechanisms allowing sympatry, it will be interesting to study interspecific relationships in other parts of their overlap, *e.g.*, Alaska and Siberia.

Dementiev *et al.* (1951) state that in the Soviet Union the European Golden Plover nests in the marshy and wetter parts of the tundra, while the Black-bellied Plover avoids these and selects the higher, dry tundra. Gladkov (in Dementiev *et al.*, 1951) says that *squatarola* and *apricaria* mutually exclude each other, but the authors comment only that *dominica* is more numerous on the Taimyr Peninsula where it shares the dry biotope with *squatarola*. Black-bellied Plovers began to lay later than Golden Plovers, when most of the uplands were free of snow, yet chose restricted areas—the most barren. They fed on dry places in contrast to the wet, often marshy places where Golden Plovers fed. The late arrival and laying, and exposed habitat, allows Black-bellied Plovers to be High Arctic breeders. In contrast, the calendar and the vegetation of their habitat suits Golden Plovers to the Low Arctic. Where Golden and Black-bellied plovers occur together, displacement (character displacement of Brown and Wilson, 1956) can be expected to exaggerate the site-preference differences. This habitat displacement must depend on the local nature of the vegetation and must be a re-

versible process, depending upon ability of one species to appropriate nesting sites of its choice.

Conflict between Golden Plover and Black-bellied Plover. On 8 and 9 July, at Golden Plover nest No. 2, a male Black-bellied Plover, which persisted in approaching too close, was repeatedly attacked and driven off. Whenever the Black-bellied approached, one or both Goldens ran at him (Figure 3), calling *pwit-pwit-pwit,* sometimes attacking in a flying dive, and the Black-bellied Plover, retreating, flew up, wheeled, and dove at one of the Goldens. The Golden stood its ground but crouched, spreading one wing momentarily (Figure 3), as the Black-bellied passed over and settled. Occasionally one of the Goldens cried *ka-sweéeooowit,* bobbing its head violently. The Black-bellied Plover held its neck stretched up (appeasement) and occasionally called *kleeeee.* The Golden Plovers did all the aggressive displaying.

When we approached, the female Golden ran up to us with head partly lowered, breast feathers fluffed out, and scolded *pwit-pwit-pwit.*

On 12 and 14 July we watched Golden Plovers pursuing female Black-bellied Plovers in three different places on the uplands and at the mouth of the river at Ooyarashukjooeet (Figure 3). Pursuits, scarcely 20 meters at Aktineq, were 100 meters to half a mile at Ooyarashukjooeet.

Our notes indicate that most trespassers were females. The conflicts increased toward the end of the incubation period, perhaps because the longer time gave the Black-bellied Plovers more opportunities to find nests. Unsatisfied incubation drives may be the behavioral basis of the trespassing because both species should respond to the similar eggs of the other. I would expect the incubation drive of a bird to decrease as the incubation period passed, if she were not incubating eggs to reinforce the drive.

Our few observations do not allow us to say whether there were interspecies territorial struggles or not. But Golden Plovers laid eggs about two weeks before the Black-bellied Plovers in "neighboring" territories, and the periods during which territorial aggression is evident must differ.

These conflicts expose the eggs of Golden Plover to greater danger from cold and predators, but we found no lessened nesting success. The species that harries another while incubating its own eggs can be expected to hold the breeding ground. It will be interesting to see the expression that the competition takes farther south, where Golden Plovers replace Black-bellied Plovers.

The third plover (Ringed Plover) occupied the especially barren or vegetation-free habitat of active sea beaches and abandoned river bars.

Differences of habitat, size, and displays (voice and patterns of plumage) separated this population so that there was no problem of overlap or competition.

Interaction of sandpipers. The three species of sandpipers ignored each other. Baird's Sandpipers arrived, probably by 1 June, and occupied the most barren places to nest and feed on surface-living insects. White-rumped Sandpipers arrived on 19 June and occupied vegetated, relatively sheltered areas. They fed by probing deeply into the moss. We found Sanderlings on dry, frost-lined uplands where we saw neither of the other species. Baird's is adapted to High Arctic breeding grounds, while the White-rump is adapted to the mossy bogs of the Low Arctic. I have no data on the feeding of the High Arctic Sanderling on its breeding grounds, but on migration it probes shallowly and frequently uses a turnstonelike technique in seaweed.

In the two plovers and the two sandpipers that we studied in detail, territorial boundaries were universally ignored by the time the young had hatched and left the nests. Parents and their young readily crossed territories and gathered in favored feeding places. This argues against any direct food function of territory unless in the realm of a "non-proximate" influence of preventing aggregation of breeding pairs beyond a "certain concentration." This concentration will be very hard to establish, because territories are highly compressible, especially under conditions that lead to crowding, *e.g.*, a late spring. Such conditions do not vary with the food supply at the time when the young have hatched and are learning to find food—one of the critical times of food pressure.

IV. Ethology of Distraction Displays

Although I recognize the fundamental value of the scheme of "conflict of drives" proposed by Hinde and Tinbergen (1951), I think that to classify all displays as the result of the relative strengths of the conflicting drives is to oversimplify. Is it not possible that many displays have been selected for themselves and their present function, without concern for their basic motivation? Is it not possible, too, that the original motivation may itself have become lost, transferred, or ritualized? Furthermore, if the immediate motivational context exists, as that theory suggests, why is there the great difference in specificity between distraction and courtship displays?

Distraction displays are selected to function as a whole. I endorse Simmons' (1955) abandonment of his earlier classification, which separated "static" and "mobile" lures, because such classifications (see also Armstrong, 1949) suggest uniformity in what is actually a spectrum of

intensity, as Simmons pointed out. He also pointed out that the use of the word "displacement" activity, as it applies to aggressive and brooding drives, is misleading in distraction displays, and he emphasized the importance of the aggressive motivation.

The explanation of distraction displays, on the basis of a conflict situation, suggests a basis for the gradation and variation seen during a series of encounters; but I agree with Simmons that distraction displays are not expressions of drives thwarted *at present*, and are clearly ritualized into a specific action of survival value. It is also obvious (Skutch, 1955) that there cannot be impairment of coordination. In the conflicts between Golden and Black-bellied plovers, all distraction displays were absent—even nest-defense postures. Deane (1944) reported a marked difference in distraction displays of Killdeer, when directed to cow or horse, or to man—yet the same conflicts of drives were present. Clearly, then, these postures are not an expression only of conflict of attack and flee drives, but are separately ritualized. At present, although there is gradation in the intensity of display, each stage in the gradation is uniform. If present conflicts of drives were responsible for impeded actions, one would expect different forms and combinations of actions from each individual at each visit. Instead, the whole distraction action is ritualized and selected as a unit.

Plovers. Males of both Black-bellied and Golden plovers showed aggression to the intruder (head lowered and back feathers ruffled) and occasionally came very close in a conspicuously aggressive posture. The aggressive rush was more evident in Black-bellied than in Golden action, perhaps because the male did most of the distraction. The butterflylike display flight in distraction of Ringed Plovers must be largely motivated by hostility, as it is in its intraspecies context. This grades into a demonstration display, which is even more conspicuous in other species: Baird's Sandpiper and Lesser Yellowlegs *(Totanus flavipes)*—(in my experience); godwits *(Limosa)*; Redshank *(Totanus totanus)*—(Simmons, 1955).

The gradation of each action into most of the others must be emphasized. As the drives of aggression, flight, brooding, fear, and concealment rise and fall, the bird approaches and threatens, settles into a hollow, flattens itself on the ground, and spreads its wings—yet stamps its feet and beats its wings. Any movement stimulates fleeing, and the bird runs off, flopping or shuffling. The aggressive actions, the standing and calling ("static lure"), and the flight over the ground ("mobile lure" or "rodent run"), all serve, in present practice, functions different from their "original" conflict of motives. They now serve to attract attention and lead the intruder off. As such, the actions are ritualized,

but this does not mean that the basic "tendencies" are totally removed.

It has been generally accepted that a movement can become ritualized —thus stereotyped, modified, and removed from its original context. Is it not possible that a posture can become ritualized and removed from its original motivational context, too? Meyerriecks (1959) documents the emancipation from the attack-flee-sex motivational conflict of crest raising in Green Heron *(Butorides virescens)*. I suggest that distraction displays must be considered separate from their original motivations and that the whole act has become ritualized, including its motivation. The concept of conflict of drives is an excellent ground work for understanding, but it is dangerous to explain all postures, and especially the highly ritualized ones, on the basis of their elements of hostility, sex, and fleeing. An action such as distraction display may itself become a unified "uneasiness action" or "displacement activity." Once this has happened, interpretation of the elements of the posture according to the meaning of the components in an "original" conflict situation will produce either nonsense or an unnecessarily complex "dissection." The action is an element in itself, no longer compound. In this context, the elements of attack, flee, and sex exist as motivations—but also, so do distraction, nest defense, alarm, response to predator, and probably many others.

Sandpipers. The sandpiper species varied in the amount of calling during distraction, and in aggressiveness. It may not be coincidence that Baird's dancing, wing-quivering distraction was not present in the White-rump. In White-rumped Sandpipers, a similar act is part of the courtship ceremony! The brooding or nest-defense posture, conspicuous in the plovers' actions, was not conspicuous in those of the sandpipers. The brooding drive was stronger in sandpipers than in plovers, however, because the parent sat closer. The difference may be associated with difference in size and color.

Comparison distraction and courtship displays. Why are similar distraction displays so widespread and courtship actions so specific? The similar series of actions in the distraction of plovers and sandpipers may be "old actions" or the result of convergence in the tundra habitat, but they do not occur in the other families we observed. In contrast, the well-known tameness of tundra species is probably convergence, because of the distances a parent can be seen once it leaves the nest. This visibility requires that parents abandon early or sit tight.

The uniformity of distraction display in the plovers and sandpipers, even to the point of retaining the broad intergradations of action, is shown by the uniformity of actions at different nest sites, and it contrasts with the differences in courtship and hostility displays. This is

to be expected from the "purpose" of these actions. *Distraction* has a shotgun effect, and the selective action of species-specific differentiation serves no purpose. In contrast, in *courtship*, selective advantage, where species overlap, has ritualized certain actions and emphasized differences that provide the species with isolating mechanisms (Brown and Wilson, 1956). In the courtship displays there is uniformity in detail, presumably because of the one male to one female relation in pair formation, in contrast to the one to "anyone" in distraction. Both types of ceremony are uniform, but in the one, each specific act is important; and in the other, only the whole effect is important, and it must be generalized enough to attract attention of several kinds of predators. Because of this ritualization, the original motivations are not clear in distraction, and only comparative studies can clarify them. For example, the nest-defense posture is modified in Golden Plover to a bow, with beating wings (Figure 3), and is nearly unrecognizable as defense in Black-bellied Plover, where it has become a helpless bird prostrate on the ground—but prostrate only in hollows (Figure 4) that hold a "nest" when the drives are of lower intensity.

LITERATURE CITED

ALLEN, A. A. 1934. The Golden Plover. Bird-Lore, **36** (5): 321–332.

AMERICAN ORNITHOLOGISTS' UNION. 1957. Check-list of North American birds (fifth edition). Baltimore, Md. 691 pp.

ARMSTRONG, E. A. 1947. Bird display and behaviour. Oxford Univ. Press. New York. 430 pp.

ARMSTRONG, E. A. 1949. Diversionary display. Ibis, **91**: 88–97, 179–188.

ARMSTRONG, E. A. 1952. The distraction displays of the Little Ringed Plover and territorial competition with the Ringed Plover. Brit. Birds, **45**: 55–59.

BIRULA, A. A. 1907. Ocherki iz zhizni pits poliarnavo poberezhia Sibiri. [Information on the life of the birds of the polar coast of Siberia.] Memoires de l'Academie Imp. des Sciences de St. Petersbourg, Cl. physiomathém, **18**: 75–80.

BOCK, W. 1958. A generic revision of the plovers (Charadriinae, Aves). Bull. Mus. Comp. Zool., **118** (2): 27–97.

BOCK, W. 1959. The status of the Semipalmated Plover. Auk, **76**: 98–100.

BRANDT, H. 1943. Alaska bird trails. Bird Research Foundation, Cleveland. 464 pp.

BROWN, R. H. 1938. Breeding habits of the Dunlin. Brit. Birds, **31**: 362–366.

BROWN, W. L., JR., and E. O. WILSON. 1956. Character displacement. Systematic Zool., **5** (2): 49–64.

COUES, E. 1861. A monograph of the Tringeae of North America. Proc. Acad. Nat. Sci. Phila., **1861**: 170–205.

DARWIN, C. 1859. The origin of species by means of natural selection. Modern Library, New York. 386 pp.

DATHE, H. 1953. Der Flussregenpfeifer. Die Neue Brehm-Bücherei. Leipzig. 1–38.

DEANE, C. D. 1944. The broken wing behavior of the Killdeer. Auk, **61:** 243–246.

DELACOUR, J. 1951. The significance of the number of toes in some woodpeckers and kingfishers. Auk, **68:** 49–51.

DEMENTIEV, G. P., N. A. GLADKOV, and E. P. SPANGENBERG. 1951. Ptitsy Sovyet Soyuza. [The birds of the Soviet Union.] State Publishing House "Soviet Science," Moscow. Vol. 3. 680 pp.

DRURY, W. H., JR., and M. C. DRURY. 1955. The Bylot Island expedition. Bull. Mass. Aud. Soc., **39** (6): 259–265.

DUBOIS, A. D. 1936. Habits and nest life of the Desert Horned Lark. Condor, **38:** 49–56.

DUBOIS, A. D. 1937. The McCown's Longspurs of a Montana prairie. Condor, **39:** 233–238.

EDWARDS, G., E. HOSKING, and S. SMITH. 1947. Aggressive display of the Ringed Plover. Brit. Birds, **40:** 12–19, pls. 1–8.

ENGLAND, M. D., E. O. HÖHN, E. G. PEDLER, and B. W. TUCKER. 1944. The breeding of the Little Ringed Plover in England in 1944. Brit Birds, **38** (6): 102–111.

FÄNGE, R., K. SCHMIDT-NIELSEN, and H. OSAKI. 1958. The salt gland of the Herring Gull. Biol. Bull., **115:** 162–171.

GIBB, J. 1954. Feeding ecology of tits, with notes on tree creeper and goldcrest. Ibis, **96:** 513–543.

HARBER, D. D. 1955. The birds of the Soviet Union (a review of Vol. 3). Brit. Birds, **48:** 313–319.

HARTERT, E. 1912–1921. Die Vögel der Paläarktischen Fauna. Berlin.

HARTLEY, P. H. T. 1953. An ecological study of the feeding habits of the English titmice. Jour. of Animal Ecol., **22:** 261–288.

HAVILAND, M. D. 1915a. Notes on the breeding habits of the Curlew Sandpiper. Brit. Birds, **8:** 178–183.

HAVILAND, M. D. 1915b. Notes on the Grey Plover on the Yenesei. Brit. Birds, **9:** 162–166.

HAVILAND, M. D. 1916. Notes on the breeding habits of Temminck's Stint. Brit. Birds, **10:** 157–165.

HEINROTH, O. 1911. Beiträge zur Biologie, namentlich Ethologie und Psychologie der Anatiden. Verhandl. V. Int. Ornith. Kongr., Berlin, **1910:** 589–702.

HINDE, R. A. 1951. Further report on the inland migration of waders and terns. Brit. Birds, **44:** 329–346.

HINDE, R. A. 1953. The conflict between drives in the courtship and copulation of the Chaffinch. Behaviour **5:** 1–31.

HÖHN, E. O. 1957. Observations on display and other forms of behavior of certain arctic birds. Auk, **74** (2): 203–214.

HØRRING, R. 1937. Birds collected on the fifth Thule expedition. Rept. 5th Thule exped. 1921–24 (Dan. Exped. Arctic N. Amer. in charge of Knud Rasmussen), 2, Nos. 6 (Zool.: Birds): 134 pp., folding map.

KEITH, D. B. 1938. Observations on the Purple Sandpiper in Northeastland. Proc. Zool. Soc. London, **108A:** 185–194.

LACK, D. 1954. The natural regulation of animal numbers. Oxford University Press, London. 342 pp.

LAVEN, H. 1940. Beiträge zur Biologie des Sandregenpfeifers (*Charadrius hiaticula* L.). Jour. f. Ornith., **88:** 183–287.

LEDLIE, R. C. B., and E. G. PEDLER. 1938. Nesting of the Little Ringed Plover in Hertfordshire. Brit. Birds, **32:** 90–102, pls. 3, 4.

LORENZ, K. 1935. Der Kumpan in der Umwelt der Vogel. Jour. f. Ornith., **83:** 137–213, 289–413.

LORENZ, K. 1941. Vergleichende Bewegungsstudien an Anatinen. Jour. f. Ornith., **89,** Sonderheft, 194–293.

LOWE, P. R. 1922. On the significance of certain characters in some Charadriine genera, with a provisional classification of the order Charadriiformes. Ibis, **1922:** 475–494, pl. 6.

LOWE, P. R. 1933. Structural diversity in Charadriine genera correlated with differences in colour-pattern. Ibis, **1933** (1): 112–129, pls. 4–5. (See also Apr. (2): 351–352.)

MACARTHUR, R. H. 1958. Population ecology of some warblers of northeastern coniferous forests. Ecology, **39:** 599–619.

MASON, A. G. 1947. Territory in the Ringed Plover. Brit. Birds, **40:** 66–70.

MAYR, E. 1942. Systematics and the origin of species. Columbia University Press, New York. 334 pp.

MAYR, E. 1958. Behavior and systematics. Chapter 16, behavior and evolution, pp. 341–362. Yale University Press, New Haven.

MAYR, E., and J. DELACOUR. 1945. Notes on the taxonomy of the birds of the Philippines. Zoologica, **30:** 106–107.

MEVERRIECKS, A. J. 1959. Comparative breeding behavior of four species of North American herons. Publications of the Nuttall Orn. Club, No. 2. 158 pp. + 15 pl. Cambridge, Mass.

MILLER, R. S. 1955. A survey of the mammals of Bylot Island, Northwest Territories. Arctic, **8** (3): 166–176.

MITCHELL, M. 1935. Injury feigning movements of Ringed Plover. Brit. Birds, **29:** 61.

MOYNIHAN, M. 1955. Some aspects of reproductive behaviour in the Black-headed Gull (*Larus ridibundus ridibundus* L.) and related species. Behaviour, Supplement No. 4, 201 pp. Leiden.

NISBET, I. C. T. 1957. Wader migration at Cambridge sewage farm. Bird Study, **4:** 131–147.

PICKWELL, G. B. 1942. *Otocoris alpestris praticola.* Prairie Horned Lark. *In* Bent, Life Histories, U.S. Nat'l Mus. Bull. No. 179, pp. 342–356.

PITELKA, F. A. 1959. Numbers, breeding schedule, and territoriality in Pectoral Sandpipers of northern Alaska. Condor, **61:** 233–264.

PLESKE, T. D. 1928. Birds of the Eurasian tundra. Mem. Boston Soc. Nat. History, **6:** 111–485, 37 plates.

PORTENKO, L. A. 1959. Studien an einigen seltenen Limicolen aus dem nördlichen und östlichen Sibirien II—Der Sichelstrandläufer—*Erolia ferruginea* (Pontopp.). Jour. f. Ornith., **100:** 141–172.

RIDGWAY, R. 1919. The birds of North and Middle America. U.S. Nat'l Mus. Bull. No. 50, Part 8. 852 pp.

SALOMONSEN, F. 1950–51. The birds of Greenland. Munksgaard, Copenhagen. 608 pp.

SCHERMAN, K. 1956. Spring on an arctic island. Little, Brown and Co., Boston. 323 pp.

SCHMIDT-NIELSEN, K. 1959. Salt glands. Scientific American, **200** (1): 109–116.

SEEBOHM, H., and J. A. HARVIE-BROWN. 1876. Notes on the birds of the lower Petchora. Ibis, **1876:** 105–126, 215–230, 289–311, 434–456; col. pls. 5, 7.

SHARPE, R. B. 1899. A hand-list of the genera and species of birds. Vol. 1. London.

SHORTT, T. M., and H. S. PETERS. 1942. Some recent bird records from Canada's Eastern Arctic. Can. Jour. Res., **D20:** 338–348.

SIMMONS, K. E. L. 1952. The nature of the predator-reactions of breeding birds. Behaviour, **4:** 161–171, 3 figs., pls. 5, 6.

SIMMONS, K. E. L. 1953. Some aspects of the aggressive behaviour of three closely related plovers *(Charadrius)*. Ibis, **95:** 115–127, 4 figs.

SIMMONS, K. E. L. 1955. The nature of the predator-reactions of waders towards humans; with special reference to the role of the aggressive-, escape-, and brooding drives. Behaviour, **8:** 130–173, pls. 1–10.

SKUTCH, A. 1955. The parental stratagems of birds. Ibis, **97:** 118–142.

SOPER, J. D. 1928. A faunal investigation of southern Baffin Island. Nat'l Mus. Canada Bull. No. 53 (Biol. Ser., No. 15). 143 pp. (incl. 7 pls.), map.

SUSCHKIN, P. P. 1908. Ptitsy Sredneĭ Kirgizskoi stepi (Turgaiskaia Oblast i vostochnaia chast Ural'skoi). [The birds of the mid-Kirgiz Steppe.] Mat. k posnauiju fauny i flory Ross. Imp. Wyp., **8:** 151–154.

SUTTON, G. M. 1932. The birds of Southampton Island. Mem. Carnegie Mus. 12 (Part II, sect. 2). Pittsburgh, 275 pp.

SUTTON, G. M. 1954. Nesting of the Snow Bunting on Baffin Island. Wilson Bull., **66** (3): 159–179.

SUTTON, G. M., and D. F. PARMELEE. 1955. Breeding of the Semipalmated Plover on Baffin Island. Bird-Banding, **26:** 137–147.

SUTTON, G. M., and D. F. PARMELEE. 1956. On certain Charadriiform birds of Baffin Island. Wilson Bull., **68** (3): 210–223.

TINBERGEN, N. 1951. The study of instinct. Oxford Univ. Press, New York and London, 228 pp.

TUCK, L. M., and L. LEMIEUX. 1959. The avifauna of Bylot Island. Dansk. Orn. Foren. Tid., **53:** 137–154.

VAN TYNE, J., and W. H. DRURY, JR. 1955. A study of breeding shorebirds in the High Arctic. Abstracts of papers at the A.O.U. 73rd Stated Meeting, Oct. 25–30, 1955.

VAN TYNE, J., and W. H. DRURY, JR. 1959. The birds of southern Bylot Island, 1954. Occasional Papers of the Mus. Zool. Univ. Mich., No. 615: 1–37.

WAGNER, H. O. 1930. Über Jahres- und Tagesrhythmus bei Zugvögeln. (I. Mitteilung). Zeits. vergl. Physiol., **12:** 703–724.

WALKINSHAW, L. H. 1948. Nestings of some shorebirds in western Alaska. Condor, **50:** 220–223.

WASHBURN, A. L. 1956. Classification of patterned ground and a review of suggested origins. Bull. Geol. Soc. Amer., **27:** 823–866.

WILLIAMSON, K. 1947. The distraction display of the Ringed Plover, *Charadrius hiaticula hiaticula* L. Ibis, **89**: 511–513.

WILLIAMSON, K. 1948. Field notes on nidification and distraction display in the Golden Plover. Ibis, **90** (1): 90–98.

WITHERBY, H. F., F. C. R. JOURDAIN, N. F. TICEHURST, and B. W. TUCKER. 1938, 1940. The handbook of British birds, Vol. IV. Witherby, London. 461 pp.

WYNNE-EDWARDS, V. C. 1952. Zoology of the Baird expedition (1950). 1. The birds observed in central and southeast Baffin Island. Auk, **69** (4): 353–392.

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A CONTRIBUTION TO THE LIFE HISTORY OF THE CLAY-COLORED SPARROW

GLEN A. FOX

DURING the summer of 1959 I made a study of the Clay-colored Sparrow *(Spizella pallida)*, near Kindersley, Saskatchewan. I observed seven nesting pairs of unmarked birds during the breeding season. The only published studies of this species in recent years are those of Walkinshaw (1939 and 1944).

ENVIRONMENT

The study area, approximately six hectares (15 acres), was prairie grassland, surrounding a large dam. A shelterbelt of Box Elder *(Acer negundo)*, approximately six meters in height, surrounded the study area. In addition to prairie grasses, shrubby vegetation in this area included snowberry *(Symphoricarpos)*, rosebush *(Rosa)*, sage *(Artemisia)*, and willows *(Salix)*.

The study began on 16 May 1959 and continued until 28 June 1959. A total of 80 hours was spent in observation, usually from 0630 to 0900 M.S.T. daily and about 10 hours per day on week ends.

TERRITORY

Censuses made on 22 May and 6 June, showed that there were 12 pairs of Clay-colored Sparrows on the study area. The minimum distance from each nest to the nearest nest of another pair among the seven nests studied varied from 20 to 900 meters. The mean distance was 385 meters.

Several male Clay-colored Sparrows were observed to chase intruding Clay-colored Sparrows from their territories. One male Clay-colored Sparrow chased from his territory a Song Sparrow *(Melospiza melodia)*, but showed no aggressiveness toward Eastern Kingbirds *(Tyrannus tyrannus)*, which occasionally perched beside him on his singing perch.

MATING

Copulation took place on a horizontal branch of a tree or bush from 0.3–2 meters above the ground. Two pairs were observed copulating. One copulation was observed on 7 June 1959. The female crouched in soliciting posture with head and tail slightly raised and wings vibrating;

the male approached, hovered momentarily and dropped upon her while the female uttered a *tit, tit, tit* call. The first egg of that pair was laid on 11 June 1959. Copulation was not observed after the beginning of egg laying.

On 6 June 1959 a flight display was observed before the act of copulation of another pair. The pair flew from their perches and looped upwards, meeting each other and making contact with the ventral area at the bottom of each loop. Both sexes called *tit, tit, tit* constantly during the display in which they rose to a height of about six meters. They then copulated on a small bush.

Nests and Nest Building

In five pairs observed, nest building was by the female only, usually during the morning. The female frequently was accompanied by the male on her trips for nesting materials, which she gathered within 100–150 meters of the nest. During a one-hour period—1010–1110 C.S.T., on 6 June 1959, during the first day of nest building—one female brought materials 22 times. On 11 of these visits she was accompanied by the male. The female uttered a *tit, tit, tit,* while gathering nesting material. Nest construction required two to four days in four pairs observed.

The female first constructed a platform, then sitting with tail erect she turned in the nest, molding it to fit her body contour. She arranged the material in the rim with her bill as she turned.

Of nine nests I measured, dimensions were as follows: inter. diam.—55 mm. (50–70 mm.); exter. diam.—80 mm. (70–95 mm.); inter. depth—45 mm. (40–50 mm.). These measurements may be compared with Walkinshaw's (1944): inter. diam.—45.9 mm (40–54 mm.); exter. diam.—105 mm. (80–140 mm.); inter. depth—37.6 mm. (25–48 mm.). These measurements were taken in Michigan.

The distance of the nest above ground was 80 mm. A typical nest contained an outer cup of 450 pieces of grass and an inner cup of 155 pieces of plant fibers, fine roots, and hair. Walkinshaw (1939) counted 384 pieces of grass in one nest. Seven nests were located in snowberry, one in grass, and one on the ground under a tussock of grass.

Renesting

Apparent renesting was observed twice in 1959. Although none of the birds was marked, the two males involved were assumed to be the same by their use of characteristic singing perches, nesting territory,

and feeding area. Both second nests were located in the original territories.

1. The original nest site was deserted on 6 June 1959 on the second day of construction. On 13 June I found the second nest containing five eggs, 16 meters from the old nest and 18 cm. above the ground. Both nests were located in Snowberry. The second nest was deserted on 17 June after four eggs had been removed by an unknown predator.

2. The female laid eggs in the original nest on 10 and 11 June but was not seen near the nest during these days. During this time she was observed in the vicinity of a second nest and was seen carrying nesting materials. On 13 June the second nest was located 23 meters from the old nest; but the female was incubating three eggs of the Brown-headed Cowbird *(Molothrus ater)*. The new nest was unlined and 45 mm. closer to the ground, being situated in a tussock of grass rather than in Snowberry. The second nest was similar in size to the original nest but lighter and contained less material. The three cowbird eggs were incubated for six additional days before the clutch was destroyed and the female deserted.

Eggs, Egg Laying and Incubation

Dates of nest completion and the first egg laid for three nests were as follows: 6 and 7 June, 8 and 10 June, 9 and 11 June. In these three nests the eggs were apparently laid in the early morning and at 24-hour intervals, as an increase always occurred between 2000 and 0630 the following morning. Eight nests (one a renesting) contained four eggs, and one contained five. In the three nests observed, incubation commenced with the laying of the final egg (observed in one nest) or the day prior to the laying of the last egg (observed in two nests) in the clutch.

The incubation period in one nest was 11 days. On 10 June the nest contained three eggs. The following morning it contained four. No further increase was observed. When it was visited on 20 June it still contained eggs, but on the next afternoon, it contained three young.

The female did most of the incubating, the male (singer) assisting for short periods only. The female would fly away from the nest, and the male, who was always nearby, would fly directly to the nest and commence to incubate. During a three-hour period, 1400–1700 C.S.T. on the first day of incubation, one female was on the nest 81 per cent of the time, the male (singer) replaced her for 13 per cent of the time, the nest being uncovered 6 per cent of the total time.

While off duty the male darted out from his singing perch "Fly-

catcher fashion" and captured insects. During a rain one male drank the water from the leaves as he moved about his territory. On an extremely hot day one off-duty bird was observed drinking from a body of water adjacent to its territory.

Cowbird Parasitism

Of nine nests studied, eight (88.8 per cent) were parasitized by Brown-headed Cowbirds. In six of these nests (75 per cent) the cowbirds' eggs were laid when the sparrow eggs were fresh. Of these six nests four contained two cowbird eggs, and two contained one such egg. In one nest the cowbird egg was laid after the four young sparrows had hatched. Three cowbird eggs were laid in a replacement nest before the female sparrow was able to finish the nest or lay eggs.

In two nests, both of which contained four eggs of the Clay-colored Sparrow, I believe the cowbirds may have eaten or removed the eggs of host. Shells were found at the base of the nest after the cowbirds had laid their eggs in the nests that had formerly contained four sparrow eggs. Three nests containing one, two, and four eggs, respectively, were deserted after they were parasitized by cowbirds, and four others were destroyed by an unknown predator. None of the cowbird eggs hatched. No Clay-colored Sparrows hatched in nests parasitized by cowbirds before the young hatched.

Young and Their Development

In the only successful nest in the study area in 1959, three young hatched on 21 June and were observed daily. The newly hatched young were covered with a sparse, light-gray down. The skin and legs were pinkish. The rictal area was white, the mouth lining was a bright orange-red with a black and yellow palate. The eyes were closed. Gaping occurred at the slightest movement.

At one day of age the alar, humeral, caudal, spinal, capital, and ventral tracts showed as dark dots beneath the skin. Changes in color of the gape were noted on the third and fourth days, when the mouth lining darkened and the rictal area turned yellow.

The eyes opened slightly at two days, defecation began at four days of nest life.

The primaries measured one mm. at three days of age and eight mm. at five days of age.

The tarsus measured six mm. at hatching and 16 mm. on the fifth day of nest life. The culmen measured four mm. at hatching and six mm. on the fifth day of nest life.

All three nestlings left the nest at seven days (28 June), when they were completely covered with unsheathed feathers. They were in the nest 27 June at 1830 but had left by 1600 28 June.

Parental Care

The presumed female did most of the brooding, the presumed male (singer) brooding occasionally for short periods. On the second day of brooding, 22 June, one female was on the nest 71 per cent of the time, the male (singer) replaced her for 9 per cent and the young were uncovered 20 per cent of the time over a two-hour period, 1345–1545 C.S.T.

At this same nest, over the same period of time, the female made one feeding visit per hour while the male averaged six visits per hour. The length of the interval between feedings averaged nine minutes.

Nesting Success

Out of 27 eggs laid in nine nests in 1959, four eggs in one nest hatched. Of the failures, 25 per cent seemed to be due to parasitization by cowbirds. The other failures, or 59.3 per cent, were due to unknown causes.

Acknowledgments

I am indebted to Mr. Oscar M. Root of North Andover, Mass., who suggested this study, and to Mr. Eugene Eisenmann for his suggestions and encouragement.

Literature Cited

Walkinshaw, L. H. 1939. Notes on the nesting of the Clay-colored Sparrow. Wilson Bull., **51**: 17–21.

Walkinshaw, L. H. 1944. Clay-colored Sparrow notes. Jack-Pine Warbler, **22**: 119–131.

Kindersley, Saskatchewan, Canada.

PROCEEDINGS OF THE SEVENTY-EIGHTH STATED MEETING OF THE AMERICAN ORNITHOLOGISTS' UNION

H. G. DEIGNAN, SECRETARY

THE Seventy-eighth Stated Meeting of The American Ornithologists' Union was held from 23 to 27 August 1960, at The University of Michigan, Ann Arbor. Business sessions were held on 23 August, papers sessions on 24, 25, and 26 August, and field trips were made on 27 August. Sponsoring organizations were the Detroit Audubon Society, the Michigan Audubon Society, the Museum of Zoology of The University of Michigan, and The Museum of Michigan State University.

BUSINESS SESSIONS

On 23 August, the Council met throughout most of the day, the Fellows met late in the afternoon, and the Fellows and Elective Members met together in the evening. The Council held a second meeting in the afternoon of 25 August, at which time there was also held a brief extraordinary meeting of Council and Fellows.

1961 meeting. The Seventy-ninth Stated Meeting will be held from 17 to 20 October 1961, at Washington, D.C., by invitation of The United States National Museum and the Bureau of Sport Fisheries and Wildlife, U.S. Fish and Wildlife Service, as host organizations, and the Audubon Naturalist Society of the Central Atlantic States, a sponsoring organization.

Tentative consideration is being given to Salt Lake City, Utah, for the 1962 meeting, and to Gainesville, Florida, for the one of 1963.

Amendment of the Bylaws. An amendment concerning the cost of Life Membership in the Union was given preliminary approval by the Fellows and Council. It will receive final action by the Fellows at the 1961 meeting. The amendment will require change in the wording of the Bylaws as follows

Article V, Section 6, now worded "Life Membership, exempting the holder from all further dues or assessments, may be obtained by members of all classes upon a single payment of one hundred dollars or payment of a like sum in four equal annual installments," to read "Life Membership, exempting the holder from all further dues or assessments, may be obtained by members of all classes upon a single payment of thirty (30) times the current annual dues. This sum may be paid in

a single payment or in four equal, annual installments, over four successive years."

Awards. The Brewster Memorial Award, by action of the Council, was made to Donald S. Farner, with the following citation:

> "His experimental work has probed deeply into the fundamentals of avian physiology. He also has made a signal contribution to the ornithology of the Western Hemisphere by bringing abstracts of significant foreign literature to the attention of American ornithologists, and he has carried out important analyses of bird-banding data. His published work has been distinguished by its insight and its scholarship, and, in many ways, he epitomizes the modern approach to ornithological research."

Marcia Brady Tucker Awards, assisting young ornithologists of promise to attend the annual meeting, were given by vote of the officers to Peter L. Ames, Yale University; William G. George, University of Arizona; and Mary Anne Heimerdinger, Yale University.

Van Tyne Memorial Awards were given, by action of the Committee on Research, to Frances T. Hamerstrom, Plainfield, Wisconsin; James Enderson, University of Wyoming; and Denis F. Owen, University of Michigan.

Membership. The Secretary reported that 3,036 copies of *The Auk* are being mailed; this mailing list includes all classes of members, subscriptions, and exchanges with other journals. The Treasurer's records showed members by classes, before the elections in this meeting, as follows:

Fellows	79
Fellows Emeriti	2
Honorary Fellows	20
Corresponding Fellows	69
Elective Members	195
Honorary Life Elective Members	8
Honarary Life Members	18
Members	2120
Student Members	79
Total	2590

Finances. The report of the Treasurer appears in full elsewhere in *The Auk*.

The dues for all dues-paying classes of members were continued at five dollars per year by vote of the Council.

Stephen S. Gregory, resigning Chairman of the Investment Trustees, reported that the appraised value of the endowment holdings, as of 31 July 1960, was $159,836. This figure includes $7,270 received in cash during the fiscal year. Without the additional monies received, the endowment holdings would have totalled only $152,566, a decline in value, from 31 July 1959, of $6,133.

Editorial matters. The Editor, Donald S. Farner, reported that three numbers of Volume 77 of *The Auk* have appeared so far in 1960, and that the fourth is in press. He stated that page proofs of the "Ten-Year Index of The Auk (1941–1950)" are now being corrected and that publication is expected before the end of 1960.

The Editor of *The Handbook of North American Birds,* Ralph S. Palmer, reported that the Yale University Press is now setting the first volume in type.

Reports of committees. W. J. Breckenridge, Chairman of the Committee on Biography, reported that one memorial to a Fellow and three obituaries (two of Corresponding Fellows, one of an Elective Member) had been published during the year ending with the July 1960 issue of *The Auk.*

During the year ending July 1960, the Committee had learned of the deaths of one Patron, one Corresponding Fellow, one Elective Member, two Life Members, ten Members, and one Student Member:

Jesse D. Anthony, Member, 1959
Albert L. Apfeld, Member, 20 November 1959
Arthur Edward Aronoff, Student Member, 12 June 1960
Paul Bartsch, Elective Member, 24 April 1960
Evelyn Vida Baxter, Corresponding Fellow, 1 October 1959
Sidney Fay Blake, Member, 31 December 1959
George Howard Burrows, II, Member, 1960
Stephen Emerson, Member, June 1959
Edith Krieger Frey, Life Member, 2 December 1959
Raymond Gano Guernsey, Patron, 19 May 1959
Solomon Paul Jones, Member, 26 January 1959
Hermann Francis Kortheuer, Member, August 1959
Horace G. Mack, Member, 25 May 1959
Walter Wehle Naumburg, Member, 17 October 1959
Flora S. Richardson, Life Member, 5 July 1960
Jerry E. Stillwell, Member, 4 September 1959

Joseph C. Howell, Chairman of the Committee on Student Memberships, reported by letter that 80 students had been named to receive *The Auk* free of charge for one year. Of the awards, five were renewals for applicants of earlier years. In 1959 the number of awards was 38.

S. Charles Kendeigh, Chairman of the Committee on Research, presented the report of his committee. It appears separately in full on pp. 242 ff.

Clarence Cottam, Chairman of the Committee on Bird Protection, presented his report, which appears separately in full on pp. 244 ff.

ELECTION OF OFFICERS

At the meeting of Fellows and Elective Members, George H. Lowery, Jr., was re-elected President, Austin L. Rand was advanced automatically to First Vice-President, John T. Emlen, Jr., was elected Second Vice-President, Herbert G. Deignan was re-elected Secretary, and Charles G. Sibley was re-elected Treasurer.

Three men were elected to the Council, with terms expiring in 1963: Dean Amadon, Roger T. Peterson, and Harrison B. Tordoff.

Donald S. Farner was re-elected Editor of *The Auk* by action of the Council. The Council also re-elected to the Board of Investing Trustees Cyrus Mark, Chairman, Arlie W. Schorger, and Stephen S. Gregory (if the last named could be induced to reconsider his resignation). The complete list of officers and members of the Council appears at the end of the Proceedings.

ELECTION TO SPECIAL CLASSES OF MEMBERSHIP

The following persons were elected to special classes of membership:

FELLOW

George A. Bartholomew, Jr.
Eugene Eisenmann
Joe T. Marshall, Jr.

CORRESPONDING FELLOW

Francisco Bernis, Spain
Jean Dorst, France
Finnur Gudmundsson, Iceland
J. Allen Keast, Australia

ELECTIVE MEMBER

James R. King, Pullman, Washington
Daniel S. Lehrman, Newark, New Jersey
David F. McKinney, Delta, Manitoba
L. Richard Mewaldt, San Jose, California
Val Nolan, Jr., Bloomington, Indiana
Miklos D. F. Udvardy, Vancouver, British Columbia

HONORARY LIFE ELECTIVE MEMBER

Winthrop Sprague Brooks, Orleans, Massachusetts

ATTENDANCE

Attendance at the meeting included 374 persons from six provinces of Canada, 36 states and the District of Columbia, Brazil, Great Britain, Mexico, Nigeria, and Southern Rhodesia, as follows:

BRAZIL—Mr. and Mrs. Augusto Ruschi.

GREAT BRITAIN—Philip Ashmole, N. G. Burton-Jones, Janet Kear.

MEXICO—Allan R. Phillips.

NIGERIA—Mr. and Mrs. Fred Sibley.

SOUTHERN RHODESIA—Mr. and Mrs. Rudyerd Boulton.

CANADA—*Alberta:* Mr. and Mrs. Robert Lister, Robert W. Turner. *Manitoba:* Frank McKinney. *New Brunswick:* A. J. Erskine, Robert Squires, Mr. and Mrs. W. Austin Squires. *Ontario:* Mr. and Mrs. A. E. Allin, James L. Baillie, C. H. D. Clarke, Dr. and Mrs. J. B. Falls, Mr. and Mrs. Rowley Frith, W. Earl Godfrey, Dr. and Mrs. William W. H. Gunn, Paul Hahn, David Hussell, Mr. and Mrs. L. E. Jaquith, Mr. and Mrs. Hoyes Lloyd, Mr. and Mrs. James K. Lowther, Dr. and Mrs. George M. Stirrett, Mr. and Mrs. James Woodford. *Quebec:* Mr. and Mrs. G. H. Montgomery, J. M. Montgomery. *Saskatchewan:* Margaret Belcher, Dr. and Mrs. George Ledingham, Robert W. Nero.

UNITED STATES: *Alaska:* Brina Kessel. *Arizona:* Richard S. Crosein, William G. George, Joe T. Marshall, Jr. *Arkansas:* Mrs. Hilery E. Hanna, Dr. and Mrs. Douglas James, Mr. and Mrs. W. S. Sugg. *California:* George A. Bartholomew, Nicholas E. Collias, Gerald Collier, John Davis, Jean Delacour, Earle E. Greene, John William Hardy, Junea W. Kelly, L. R. Mewaldt, Alden H. Miller, Robert T. Orr. *Colorado:* Paul H. Baldwin, A. Sidney Hyde, Mr. and Mrs. E. R. Kalmbach. *Connecticut:* Peter L. Ames, Mary Heimerdinger, Mrs. Harold Hibbert, Philip S. Humphrey, Roger Tory Peterson. *District of Columbia:* Shirley A. Briggs, Herbert G. Deignan, Herbert Friedmann, Dr. and Mrs. Alexander Wetmore. *Florida:* O. L. Austin, Jr., Pierce Brodkorb. *Georgia:* Herbert L. Stoddard, Sr., Ivan R. Tompkins. *Illinois:* Karl E. Bartel, L. C. Binford, Emmet R. Blake, George E. Chaniot, Philip Doerr, Dr. and Mrs. Richard R. Graber, S. Charles Kendeigh, Mr. and Mrs. L. B. Nice, Don Smith Prentice, Dr. and Mrs. A. L. Rand, Floyd Swink, Dr. and Mrs. Albert Wolfson. *Indiana:* Wilson Baker, Mildred Campbell, Mrs. S. G. Campbell, Jack Confer, James G. Cope, Robert A. Johnson, Russell E. Mumford, Val Nolan, Jr., Henry West, Nixon Wilson. *Iowa:* Peter Peterson, Jr., Mr. and Mrs. Fred J. Pierce, Milton Weller. *Kansas:* Jon Barlow, Abbott Gaunt, Richard Johnston. *Kentucky:* Mr. and Mrs. Burt L. Munroe, Burt L. Munroe, Jr., Anne L. Stamm. *Louisiana:* Douglas A. Lancaster, Dr. and Mrs. George H. Lowery, Jr., Robert Newman, Mr. and Mrs. Stephen M. Russell. *Maine:* Dr. and Mrs. Olin Sewall Pettingill, Jr., and daughter, Mr. and Mrs. Burton Whitman, Richard L. Zusi. *Maryland:* Daniel L. Leedy, Robert M. McClung. *Massachusetts:* Mr. and Mrs. L. M. Bartlett, Raymond Coppinger, William Drury, Carl Helms, Ernst Mayr, Dr. and Mrs. R. A. Paynter, Jr.

Michigan: Max Adler, G. A. Ammann, Dr. and Mrs. Ormsby Annan, Keith Arnold, Dr. and Mrs. Rollin Baker, H. Lewis Batts, Jr., Dr. and Mrs. Andrew J. Berger, Robert Bernard, Helen Blanchet, Mr. and Mrs. E. G. Boyes, Richard Brewer, Dr. and Mrs. W. H. Burt, Dr. and Mrs. W. P. Cottrille, Edward Cutler, Lee R. Dice, Marie Donegan, Dr. and Mrs. Donald Douglass, Mr. and Mrs.

William Dyer, Mary Ellsworth, Monica Ann Evans, Mr. and Mrs. Norman Ford, Ursula Freimarck, Lowell Getz, Norma Guezen, Dr. and Mrs. Harry Hann, Priscilla Hazen, M. Catherine Hinchey, Mr. and Mrs. Fenn Holden, John Howell, Maude Hukill, Marion L. Hundley, Bette Jane Johnston, Irene F. Jorae, Mrs. Neil T. Kelley, Robert Kirkendall, Justin Leonard, Dr. and Mrs. William A. Lunk, Harold D. Mahan, Joseph H. Martin, Dr. and Mrs. Daniel McGeen, James McLaughlin, Dr. and Mrs. Clarence Messner, Mr. and Mrs. Vaden Miles, Walter P. Nickell, Mr. and Mrs. Denis F. Owen, Robert Payne, Mrs. Thomas Petts, Miles D. Pirnie, Sergej Postupalsky, William Prychodko, David Rocheleau, Jon P. Rood, Donald B. Savery, Mrs. David Smith, Haven H. Spencer, Peter Stettenheim, Dr. and Mrs. Robert W. Storer, William Thompson, Heather Thorpe, Dr. and Mrs. Harrison B. Tordoff, Elsie Townsend, Mrs. Josselyn Van Tyne, Willet T. Van Velzen, James Vanden Berge, Charles F. Walker, Dr. and Mrs. Lawrence H. Walkinshaw, Dr. and Mrs. George J. Wallace, LaRue Wells, Harold F. Wing, Dr. and Mrs. Leonard Wing, Larry Wolf, Mark Wolf, Mr. and Mrs. J. T. Woolfenden, Jean Wright. *Minnesota:* James Beer, Dr. and Mrs. W. J. Breckenridge, Mr. and Mrs. Robert W. Dickerman, Arnold B. Erickson, Dr. and Mrs. P. B. Hofslund, Dr. and Mrs. Dwain Warner. *Missouri:* William Elder, Hazel Philbrick. *Nebraska:* Mr. and Mrs. John Lueshen. *New Jersey:* Mrs. Herbert E. Carnes, Ann Chamberlain, Charles T. Collins, Mrs. J. Y. Dater, Frank Gill, Bertram G. Murray, Jr., Norman B. Pilling, Jeff Swinebrod, Peter Westcott, Helen J. Williams. *New Mexico:* John P. Hubbard, Ralph J. Raitt, Jr., Dale A. Zimmerman.

New York: Dr. and Mrs. Dean Amadon and daughter, Mr. and Mrs. Harold H. Axtell, Mr. and Mrs. Winston B. Brockner, John Bull, Roland C. Clement, William Dilger, David Dunham, Stephen W. Eaton, Don R. Eckelberry, Eugene Eisenmann, Mr. and Mrs. Robert W. Ficken, Lion Gardiner, E. Thomas Gilliard, Helen Hays, James M. Hartshorne, Mr. and Mrs. Keith Stuart, Dr. and Mrs. Peter Paul Kellogg, Wesley E. Lanyon, Ethel E. Little, Mr. and Mrs. Harold D. Mitchell, D. Bruce Murray, Theodora Nelson, Ralph S. Palmer, Richard H. Pough, Mr. and Mrs. Lester L. Short, Jr., Charles G. Sibley, Paul Slud, Walter R. Spofford, Robert C. Stein, Mrs. Dayton Stoner, Mr. and Mrs. Edward Ulrich, Mr. and Mrs. Charles Vaurie, Jayson A. Walker, Joshua Wallman. *North Carolina:* Charles H. Blake, William S. James, G. Thomas Taylor. *Ohio:* Howard E. Blakeslee, Mr. and Mrs. Robert V. D. Booth, Vera Carrothers, Adela Gaede, Harold Mayfield, John Mayfield, Henri C. Seibert, Mildred Stewart, Mr. and Mrs. Milton B. Trautman. *Oklahoma:* Dr. and Mrs. Robert Burns, John A. Weins. *Pennsylvania:* Dorothy L. Bordner, Mr. and Mrs. Earl R. Bordner, Frederick V. Hebard, Kenneth C. Parkes, Frank W. Preston, W. E. Clyde Todd, Charles Trost, Mr. and Mrs. Rodman Ward, Merrill Wood. *Rhode Island:* Mr. and Mrs. Waldemar H. Fries. *South Dakota:* Byron Harrell. *Tennessee:* Albert Ganier, Mrs. Amelia R. Laskey. *Texas:* Clarence Cottam, Allan Hayse, Margaret Louise Hill, Mrs. L. T. Hill, Pauline James. *Vermont:* Mrs. James R. Downs. *Virginia:* Joseph H. Magee. *Washington:* Donald S. Farner. *Wisconsin:* John T. Emlen, Mr. and Mrs. A. C. Epple, Mr. and Mrs. Cleveland P. Grant, Joseph L. Guerino, Mr. and Mrs. Frederick Hamerstrom, Mr. and Mrs. Joseph Hickey and daughter, L. Barrie Hunt, Mr. and Mrs. Clarence S. Jung, Robert A. McCabe, Orrin J. Rongstad, Mr. and Mrs. Arlie W. Schorger, James G. Teer, Charles M. Weise.

PUBLIC SESSIONS

Papers sessions were held in the morning and afternoon of each of the three days beginning Wednesday, 24 August, in the auditorium of the Rackham Building of The University of Michigan.

WEDNESDAY MORNING SESSION

The meeting was opened by an address of welcome by Dr. Burton D. Thuma, Associate Dean of the College of Literature, Science and the Arts, The University of Michigan. George H. Lowery, Jr., President of The American Ornithologists' Union, responded. The Secretary, Herbert G. Deignan, summarized the results of the previous day's business sessions, including elections.

HAROLD F. MAYFIELD, Waterville, Ohio, *Cowbird Behavior at the Nest of the Kirtland's Warbler.*

MILTON B. TRAUTMAN, Ohio State University, Columbus, Ohio, *Habitat Changes in the Nesting Area of the Kirtland's Warbler, in 1926, 1934, 1935, and 1960.*

JOE T. MARSHALL, JR., University of Arizona, Tucson, Arizona, *Comparative Behavior of Five Forms of Brown Towhees.*

KEITH L. DIXON, Utah State University, Logan, Utah, *Extent of Utilization of Territory by Nesting Plain Titmice.*

J. BRUCE FALLS, University of Toronto, Toronto, Ontario, *Determination of Territorial Boundaries Using Tape-Recorded Songs.*

RICHARD BREWER, Western Michigan University, Kalamazoo, Michigan, *Reproductive Relationships of Black-capped and Carolina Chickadees.*

WEDNESDAY AFTERNOON SESSION

WILLIAM R. DAWSON and FRANCIS C. EVANS, The University of Michigan, Ann Arbor, Michigan, *Relation of Growth and Development to Temperature Regulation in Nestling Vesper Sparrows.*

ALDEN H. MILLER, University of California, Berkeley, California, *The Double Molt Cycle of the Andean Sparrow.*

JOHN DAVIS, Hastings Reservation, University of California, Carmel Valley, California, *Annual Weight Cycle in a Resident Population of the Rufous-sided Towhee.*

ALBERT WOLFSON, Northwestern University, Evanston, Illinois, and HIDESHI KOBAYASHI, University of Tokyo, Tokyo, Japan, *Some Observations on the Mechanism of the Photoperiodic Response.*

L. RICHARD MEWALDT and MARTIN L. MORTON, San Jose State College, San Jose, California, *Comparative Reactions of Migratory and Non-migratory White-crowned Sparrows to Like Environmental Conditions.*

CARL W. HELMS, Massachusetts Audubon Society, South Lincoln, Massachusetts, and Bucknell University, Lewisburg, Pennsylvania, *Gonadotropins and Migratory Activity.*

S. CHARLES KENDEIGH, University of Illinois, Champaign, Illinois, *Energy Conserved by Roosting in Cavities.*

GEORGE W. COX and S. CHARLES KENDEIGH, University of Illinois, Champaign, Illinois, *The Relation of Energy Requirements of Tropical Finches to Distribution and Migration.*

GEORGE J. WALLACE, Michigan State University, East Lansing, Michigan, *Dutch Elm Disease and the Robin Dilemma.*

RICHARD F. BERNARD, Michigan State University, East Lansing, Michigan, *The Presence of DDT in Avian Tissues.*

THURSDAY MORNING SESSION

NICHOLAS E. COLLIAS and ELSIE C. COLLIAS, University of California, Los Angeles, California, *Some Mechanisms of Nest Building by the African Village Weaverbird,* Textor cucullatus.

WILLIAM C. DILGER, Cornell University, Ithaca, New York, *The Evolution of Displays with Special Reference to Precopulatory Displays of* Agapornis.

MRS. WILLIAM KEETON, Cornell University, Ithaca, New York, *Evolution of Nest Building in the Parrot Genus* Agapornis.

JOHN WILLIAM HARDY, University of California, Los Angeles, California, *Pupil Flexion Display and Associated Behavior in the Orange-fronted Parakeet,* Aratinga canicularis.

MILLICENT S. FICKEN, Cornell University, Ithaca, New York, *Courtship of the American Redstart.*

ROBERT W. FICKEN, Cornell University, Ithaca, New York, *An Analysis of the Precopulary Display of the Common Grackle.*

GERALD COLLIER, University of California, Los Angeles, California, *Comparative Ontogeny of Behavior in Young Red-winged and Tricolored Blackbirds.*

THURSDAY AFTERNOON SESSION

WESLEY E. LANYON, American Museum of Natural History, New York, *The Middle American Populations of the Crested Flycatcher,* Myiarchus tyrannulus.

WILLIAM G. GEORGE, University of Arizona, Tucson, Arizona, *Two New Taxonomic Characters for Passerine Birds and Their Application to the Systematic Position of the Olive Warbler.*

MARY A. HEIMERDINGER, Yale University, New Haven, Connecticut, *An X-ray Technique for the Study of Feather Tracts.*

PHILIP S. HUMPHREY and GEORGE A. CLARK, JR., Yale University, New Haven, Connecticut, *Pterylosis of the Mallard.*

RICHARD L. ZUSI, University of Maine, Orono, Maine, *Functional Aspects of Upper Jaw Structure in Shorebirds.*

PETER L. AMES, Yale University, New Haven, Connecticut, *Syringeal Anatomy and Relationships of the Palm Chat,* Dulus.

CHARLES G. SIBLEY, Cornell University, Ithaca, New York, *The Phylogeny of Birds as Indicated by Protein Structure.*

WALTER R. SPOFFORD, State University of New York Medical College, Syracuse, New York, *Hawks, Falcons, and Owls: Comparative Electrophoresis of Their Egg-White Proteins.*

A. SIDNEY HYDE, Western State College, Gunnison, Colorado, *Nesting of Virginia's Warbler in Colorado.*

THURSDAY EVENING SESSION OF MOTION PICTURES

G. STUART KEITH, American Museum of Natural History, New York, *The Cranes of Japan, Winter.*

HELEN HAYS, Cornell University, Ithaca, New York, *The Ruddy Duck.*

DEAN AMADON, American Museum of Natural History, New York, *An Ornithologist's Argentina.*

FRIDAY MORNING SESSION

DANIEL L. LEEDY, U. S. Fish and Wildlife Service, Washington, D. C., *Some Federal Contributions to Bird Conservation from 1885 to 1960.*

LESTER L. SHORT, JR., Adelphia College, Garden City, New York, *Introgression in Flickers.*

RICHARD F. JOHNSTON, The University of Kansas, Lawrence, Kansas, *Dispersal and Spacing in Birds.*

A. J. ERSKINE and L. G. SUGDEN, Canadian Wildlife Service, Sackville, New Brunswick, and Edmonton, Alberta, *Nest Site Tenacity and Homing in the Bufflehead.*

R. A. MCCABE, University of Wisconsin, Madison, Wisconsin, *Selection of Colored Nest Boxes by House Wrens.*

TOM J. CADE, Syracuse University, Syracuse, New York, *Food and Feeding Habits of the Northern Shrike.*

DANIEL S. MCGEEN and JEAN MCGEEN, Pontiac, Michigan, *The Cowbird-Host Relationship.*

JAMES K. LOWTHER, University of Toronto, Toronto, Ontario, *Nest Habitat Selection by the White-throated Sparrow in Algonquin Park, Ontario.*

FRIDAY AFTERNOON SESSIONS

(Session 7-A—Concurrent)

PETER PAUL KELLOGG, Cornell University, Ithaca, New York, *Vocalizations of the Black Rail and the Yellow Rail.*

ROBERT C. STEIN, Cornell University, Ithaca, New York, *Sounds Used in Aggressive Behavior by Traill's Flycatchers.*

JAMES M. HARTSHORNE, Cornell University, Ithaca, New York, *Learned and Unlearned Components of the Eastern Bluebird's Vocal Repertoire.*

ANNE HINSHAW WING and LEONARD W. WING, Ann Arbor, Michigan, *Song Patterns of the Carolina Chickadee at College Station, Texas.*

A. W. SCHORGER, University of Wisconsin, Madison, Wisconsin, *An Ancient Pueblo Turkey.*

PAUL HAHN, Royal Ontario Museum, Toronto, Ontario, *My Search for Specimens of Certain Extinct North American Birds.*

WILLIAM A. DYER, Union City, Michigan, *Nesting of the Connecticut Warbler in Michigan.*

HELEN HAYS, Cornell University, Ithaca, New York, *Typical Intensity in the Bubbling Display of the Ruddy Duck.*

WILLIAM H. DRURY, JR., CARL W. HELMS, and RAYMOND P. COPPINGER, Massachusetts Audubon Society, South Lincoln, Massachusetts, *The Effects of Weather on Migration.*

WALTER P. NICKELL, Cranbrook Institute of Science, Bloomfield Hills, Michigan, *Net-Banding, An Effective Technique in Determining Homing and Longevity in Bank Swallows.*

(Session 7-B—Concurrent)

PIERCE BRODKORB and DAVID B. WINGATE, University of Florida, Gainesville, Florida, *Extinct Flightless Rails of Bermuda.*

LAWRENCE H. WALKINSHAW, Battle Creek, Michigan, *Attentiveness of the Sandhill Crane in Michigan.*

ROBERT W. NERO and FRED W. LAHRMAN, Saskatchewan Museum of Natural History, Regina, Saskatchewan, *Arctic Terns Found Nesting in Saskatchewan.*

JANET KEAR, The Wildfowl Trust, Slimbridge, Gloucestershire, England, *Food Selection in British Finches.*

MRS. JOHN Y. DATER, Ramsey, New Jersey, *Esophageal Diverticula of the Common Redpoll.*

PAUL SLUD, American Museum of Natural History, New York, *Ecological Distribution of Birds in a Tropical Wet Forest Area.*

GEORGE A. BARTHOLOMEW and THOMAS R. HOWELL, University of California, Los Angeles, California, *Temperature Regulation in Laysan and Black-footed Albatrosses.*

SOCIAL EVENTS

A luncheon for the Council and a dinner for Fellows and members of the Council were held on 23 August; in the evening a reception, sponsored by the host organizations, was held for those not attending the business session.

In the evening of 24 August a reception was held for members and guests at the Michigan Union.

Wives of members and other guests were given a special tour of the campus, followed by a tea, on the afternoon of 24 August, and, on the morning of 25 August, were taken by bus to visit Greenfield Village and the historic Botsford Inn.

The Annual Banquet took place in the Ballroom of the Michigan Union on the evening of Friday, 26 August.

FIELD TRIPS

On Saturday, 27 August, two all-day field trips were offered: one, to visit the new General Motors Technical Center and the Cranbrook Institute of Science; the other, to East Lansing and its vicinity, to visit the United States Department of Agriculture Poultry Research Laboratory, the Museum of Michigan State University, and the Rose Lake Wildlife Experiment Station of the Michigan Department of Conservation.

RESOLUTIONS

The following resolutions were submitted by the Resolutions Committee (John T. Emlen, Jr., Chairman; Kenneth C. Parkes; and Burt L. Monroe) and approved by the General Session on 26 August 1960:

1. *Whereas,* The American Ornithologists' Union, here assembled at Ann Arbor, Michigan, has taken note of the appalling destruction of bird life associated with the current widespread use of chemical pesticides, particularly in programs designed to suppress the Dutch Elm

Disease in the Northern States and the Fire Ant Problem in the Southern States; and

Whereas, Basic research during the past few years has demonstrated that serious threats of ecological unbalance exist in the prevailing insect control practices;

Therefore, Be It Resolved, That agencies concerned with the regulation of pesticide dissemination take prompt action to examine research findings and to re-evaluate and modify existing regulations in accordance with an objective evaluation of these findings; and

Be It Further Resolved, That research institutions be encouraged to continue and expand investigations on the effect of pesticide practices on wildlife and the potential dangers of the continued use of such materials; and

Be It Further Resolved, That, in formulating new regulations, responsible agencies be urged to take full cognizance of *specific* insecticides and other devices for minimizing the destruction of wildlife, and to place drastic restrictions on the use of cheap general pesticides where less dangerous materials are available; and

Be It Further Resolved, That the Secretary of The American Ornithologists' Union be instructed to transmit copies of this resolution to those departments of government whose responsibility it is to formulate and carry out the regulation of insect control activities, and to such other agencies, organizations, and officials as should be informed of this problem as the President of the Union shall designate.

2. *Whereas,* The value of any meeting is dependent upon the facilities of the meeting place and upon the energy and efficiency of the individual members of the local committee in performing their respective assignments; and

Whereas, The benefits and enjoyment of such meetings are enhanced by the cordiality and hospitality of the hosts;

Therefore, Be It Resolved, That The American Ornithologists' Union in session at its Seventy-eighth Stated Meeting commends the Museum of Zoology of The University of Michigan, the Department of Zoology of Michigan State University, the Michigan Audubon Society, and the Detroit Audubon Society for contributing greatly to the outstanding success of this meeting; and

Be It Further Resolved, That The American Ornithologists' Union expresses its appreciation to each committee member of these several groups for his or her efforts to make the 1960 meeting a memorable and profitable occasion.

OFFICERS AND TRUSTEES OF THE AMERICAN ORNITHOLOGISTS' UNION

	Expiration of Term
George H. Lowery, Jr., *President*	1961
Austin L. Rand, *First Vice-President*	1961
John T. Emlen, Jr., *Second Vice-President*	1961
Herbert G. Deignan, *Secretary*	1961
Charles G. Sibley, *Treasurer*	1961
Donald S. Farner, *Editor of The Auk*	1961

ELECTIVE MEMBERS OF THE COUNCIL

Oliver L. Austin, Jr.	1961
Harold F. Mayfield	1961
Lester L. Snyder	1961
Joseph J. Hickey	1962
Arlie W. Schorger	1962
Robert W. Storer	1962
Dean Amadon	1963
Roger T. Peterson	1963
Harrison B. Tordoff	1963
Robert T. Orr, Cooper Ornithological Society Representative	1961
H. Lewis Batts, Jr., Wilson Ornithological Society Representative	1961

EX-PRESIDENTS:
James P. Chapin, 1939–42
Herbert Friedmann, 1937–39
Hoyes Lloyd, 1945–48
Ernst Mayr, 1957–59
Alden H. Miller, 1953–56
Robert Cushman Murphy, 1948–50
Alexander Wetmore, 1926–29

INVESTING TRUSTEES

Turner Biddle	1961
Cyrus Mark	1961
Arlie W. Schorger	1961

AOU COMMITTEES 1960–1961

COMMITTEE ON BIOGRAPHY: Maurice G. Brooks, *Chairman.* Aaron M. Bagg, Hildegarde Howard, J. Murray Speirs.

COMMITTEE ON BIRD PROTECTION: Clarence Cottam, *Chairman.* Ira N. Gabrielson, H. Albert Hochbaum, Robert A. McCabe, David A. Munro, Richard Pough.

COMMITTEE ON THE BREWSTER AWARD: Austin L. Rand, *Chairman.* S. Charles Kendeigh, Alden H. Miller, A. William Schorger, Alexander Wetmore.

EDITORIAL COMMITTEE: Donald S. Farner, *Chairman.* Donald R. Eckelberry, Eugene Eisenmann, John T. Emlen, Samuel A. Grimes, Wesley E. Lanyon, Frank McKinney, Eugene P. Odum, Robert W. Storer, George M. Sutton, L. R. Wolfe.

COMMITTEE ON ENDOWMENTS: Albert Wolfson, *Chairman.* Mrs. Herbert E. Carnes, Cyrus Mark, Roger T. Peterson, Alexander Wetmore.

COMMITTEE ON FINANCE: Charles G. Sibley, *Chairman.* Herbert G. Deignan, Hoyes Lloyd, Olin Sewall Pettingill, S. Dillon Ripley, Albert Wolfson.

COMMITTEE ON THE NOMINATION OF HONORARY AND CORRESPONDING FELLOWS: Herbert Friedmann, *Chairman.* Margaret M. Nice, Albert Wolfson.

COMMITTEE ON THE NOMINATION OF FELLOWS AND ELECTIVE MEMBERS: Oliver L. Austin, *Chairman.* John Davis, Harrison B. Tordoff.

MEMBERSHIP COMMITTEE: Winston W. Brockner, *Chairman.* Mrs. Robert V. D. Booth, Dorothy Louise Bordner, Shirley A. Briggs, Angelo D'Angelo, John J. Elliott, Albert F. Ganier, Earle R. Greene, Mary A. Heimerdinger, Frederick M. Helleiner, Clarence S. Jung, John Lunn, Joe T. Marshall, Carl S. Marvel, Mrs. Osborne Mitchell, Robert W. Nero, Robert J. Newman, Val Nolan, Jr., Harold S. Peters, Peter C. Petersen, Jr., William F. Rapp, Mrs. Marjory Bartlett Sanger, George A. Smith, L. R. Wolfe, Mrs. Harriet B. Woolfenden.

PROGRAM COMMITTEE: Chandler S. Robbins, *Chairman.* Herbert G. Deignan, Philip Du Mont, W. Earl Godfrey.

COMMITTEE ON PUBLICATIONS: Editor *The Auk, Chairman.* President, Secretary, Treasurer, Editor of "Ten-Year Index to *Auk*" (L. R. Wolfe), Eugene Eisenmann.

COMMITTEE ON RESEARCH: S. Charles Kendeigh, *Chairman.* Andrew J. Berger, John T. Emlen, Donald S. Farner, Ralph S. Palmer, Milton B. Trautman, M. D. F. Udvardy.

COMMITTEE ON STUDENT AWARDS: Raymond A. Paynter, *Chairman.* Pierce Brodkorb, Robert T. Orr, George M. Sutton, Harrison B. Tordoff, Dwain W. Warner.

SPECIAL COMMITTEE ON VERNACULAR NAMES OF NORTH AMERICAN BIRDS: Roger T. Peterson, *Chairman.* Robert J. Newman, *Vice-Chairman.* Eugene Eisenmann, W. Earl Godfrey, Alden H. Miller, Kenneth C. Parkes, Olin Sewall Pettingill, Chandler S. Robbins.

SPECIAL COMMITTEE TO STUDY PROBLEMS RELATING TO AVIAN CLASSIFICATION AND THE A.O.U. CHECK-LISTS: Alden H. Miller, *Chairman.* Dean Amadon, W. Earl Godfrey, George H. Lowery, Jr., Robert W. Storer.

LOCAL COMMITTEE ON ARRANGEMENTS FOR THE 1961 ANNUAL MEETING: John W. Aldrich, *Chairman.* Elting Arnold, Shirley A. Briggs, Thomas D. Burleigh, Edwin G. Davis, Allen J. Duvall, Ray C. Erickson, Ira N. Gabrielson, Luther C. Goldman, Hartley H. T. Jackson, Joseph E. King, Daniel L. Leedy, Charles N. Mason, Alexander Wetmore, John E. Willoughby.

TREASURER'S REPORT

For the Period August 1, 1959—July 31, 1960

Income to Active Fund Account

Dues	$10,220.38
Subscriptions	1,706.40
Sale of back issues of *The Auk*	949.50
Royalties on microfilms of *The Auk*	3.02
Royalties on sales of Recent Studies	76.31
Miscellaneous sales	37.00
Advertising	669.50
Donations to Active Publication Fund	105.00
Income from:	
General Endowment Fund	2,867.78
Ruthven Deane Fund	231.44
Interest — Savings Account 1959–60	320.60
Balance in Active Account 1959	1,136.15
Total Income, 1960	$18,323.08

Special Funds

Brewster Memorial Fund		
Income from investments	$ 374.49	
Cost of Medal		$ 300.63
To Alexander Wetmore (Contributed to Endowment Fund)		73.86
	$ 374.49	$ 374.49
Bird Protection Endowment Fund		
Balance forward	$	$ 20.83
Income from investments	47.52	
Donation to International Committee for Bird Preservation		25.00
Balance in Account		1.69
	$ 47.52	$ 47.52
Educational Endowment Fund		
Balance forward	$ 215.94	
Income from investments	191.90	
80 Student Members		$ 400.00
Balance in Account		7.84
	$ 407.84	$ 407.84
Special Publication Fund		
Balance forward	$7,273.04	
Income from investments	387.15	
Received from sale of Check-lists and Recent Studies	1,797.30	
Postage		$ 54.94
Balance in Account		9,402.55
	$9,457.49	$9,457.49

XIII International Ornithological Congress

Balance forward	$ 362.50	
Transferred from 1960 Dues Account	500.00	
Balance in Account		$ 862.50
	$ 862.50	$ 862.50

Endowment Fund

Balance in uninvested funds, 1959	$ 432.21	
Life Membership payments	3,050.00	
Donations	207.00	
Sale of Audubon Prints	452.15	
To Investing Trustees		$4,100.00
Balance in Account		41.36
	$4,141.36	$4,141.36

Handbook of North American Birds Fund

Balance forward	$4,029.48	
Donation	100.00	
Supplies, etc.		$ 292.00
Balance in Account		3,837.48
	$4,129.48	$4,129.48

Marcia B. Tucker Fund

Balance forward	$ 1.86	
Donation for 1960 awards	500.00	
Peter L. Ames		$ 125.00
Mary Anne Heimerdinger		125.00
William G. George		250.00
Balance in Account		1.86
	$ 501.86	$ 501.86

Van Tyne Memorial Fund

Balance forward	$ 40.40	
Income from investments	348.91	
Received for investment	3,140.00	
To Investing Trustees		$3,170.40
Balance in Account		358.91
	$3,529.31	$3,529.31

DISBURSEMENTS

Manufacture and distribution of *The Auk*	$12,514.51
Reprints	149.22
Editor's expense ($100.00 balance of 1958–59)	1,129.67
Secretary's expense	300.00
Salary — Treasurer's Assistant	1,200.00
Additional clerical assistance — Treasurer's Office	314.12
Mailing of back issues and other publications	135.02
Addressing supplies and expense	19.87
Stationery, labels, etc.	150.61
Telephone and telegraph	5.15
Cost of dues notices	204.14
Postage	287.69
Donations:	
Zoological Society of London	50 00
International Committee on Zoological Nomenclature	10.00
International Union for Protection of Nature and Natural Resources	50.00
International Wildfowl Research Bureau	25.00
Annual Meeting ($199.00 — 1959 meeting)	462.30
10 Year Index	330.75
Student Membership Committee	10.00
Membership Committee	95.85
TOTAL EXPENDED, 1960	$17,443.90

Balance in Active Account, 1960	$ 879.18
Balance in Bird Protection Endowment Fund	1.69
Balance in Educational Endowment Fund	7.84
Balance in Special Publication Fund	9,402 55
Balance in Endowment Fund	41.36
Balance in Handbook Fund	3,837.48
Balance in Tucker Fund	1.86
Balance in Van Tyne Fund	358.91
Balance in XIII Ornithological Congress Fund	862.50
	$15,393.37
Savings Account — First National Bank, Ithaca, N. Y.	$11,611.97
Checking Account — First National Bank, Ithaca, N. Y.	3,781.40
	$15,393.37

July 31, 1960 CHARLES G. SIBLEY, *Treasurer*

REPORT OF THE RESEARCH COMMITTEE FOR 1960

The Research Committee during the past year has been concerned with two matters of special interest: the abstracting of current literature and the Van Tyne Research Awards.

Current literature. The modern bird student needs the help of bibliographic services to keep up with the current literature that is being published in increasing volume each year. The question of importance is how the citation or abstracting of this current literature can be done most efficiently and completely, and at the same time be made easily available to all who are interested.

The Recent Literature section in *The Auk* is of interest to many persons, yet in 1959, it contained only 471 citations, compared with 1,215 citations dealing with birds in *Biological Abstracts* and 2,506 in *Zoological Record*. During the same period, 329 abstracts of bird articles appeared in *Wildlife Review* and 310 in *Bird-Banding*. Many citations were duplicated in these five periodicals, yet each periodical contained citations not found in the other four. Many hours of work on the part of a large number of people are required for compiling this literature, and it is wasteful of time and energy to have the compiling done over and over independently for each journal. It is also wasteful of publication space that otherwise would be available for new research, symposia, or special review articles.

The A.O.U. Council recognizes the problem and directed the Research Committee to investigate the possibilities of coordinating the efforts of the various journals into a central abstracting or citation service that would be available to all.

Van Tyne Research Awards. The accumulated interest on the Josselyn Van Tyne Memorial Fund, or approximately $600, was made available by the treasurer for distribution in 1960, its first year of operation, as awards for the promotion of research. Announcements of the availability of this sum were made in *The Auk, Wilson Bulletin, Condor,* and *Bird-Banding*. Eight applications were received for amounts varying from $75 to $600. The awards were made at the A.O.U. meeting in Ann Arbor to Mrs. Frances Hamerstrom of Plainfield, Wisconsin, for field studies of the Marsh Hawk, Mr. James Enderson of the University of Wyoming for field studies of the Prairie Falcon, and Mr. D. F. Owen of the University of Michigan for study of the color phases of the Screech Owl.

Criteria used in rating the projects included the usual factors of originality, promise of results, fundamental importance of the subject,

knowledge and background of the investigator, and organization and modesty of the request. Of special importance in the minds of the committee was how the funds could be made of unique or unusual significance for the advancement of ornithology. Nearly all committee members agreed that where the projects were of approximately equal importance, preference should be given the young investigator, rather than the established university professor or museum man, and to investigators without good opportunities of securing financial aid elsewhere.

On the basis of this first year's experience, it appears that this fund may come to serve a very useful and important function for the advancement of ornithological research. A sum of money at least three times that available this year could have easily been assigned with promise of bringing worthwhile results. An increase of the capital investment in this fund would be desirable.

ANDREW J. BERGER
JOHN T. EMLEN
DONALD S. FARNER
RALPH S. PALMER
HARRISON B. TORDOFF
MILTON B. TRAUTMAN
M. D. F. UDVARDY
S. C. KENDEIGH, *Chairman*
Vivarium Bldg., University of Illinois, Wright and Healey Sts., Champaign, Illinois

REPORT TO THE AMERICAN ORNITHOLOGISTS' UNION BY THE COMMITTEE ON BIRD PROTECTION, 1960

Many events having an impact on birds have transpired since our last A.O.U. meeting, and many serious problems confront all our people who have an interest in bird life. Our exploding populations, competition for land, land management and mismanagement, and particularly the promiscuous and irresponsible use of pesticides and unrestrained drainage (both of which are often encouraged and supported by federal agencies), all are having a serious effect upon wildlife.

Other events and developments have improved the situation for birds. The American public is gradually becoming more conscious and appreciative of birds and is, therefore, according them better protection. Habitat development by both government and private citizens and agencies has made the environment more attractive and safer for many species and in many areas. Perhaps the greatest contribution this past year has been the constant effort of many understanding and dedicated groups in preventing the destructive march of organized forces from doing even more damage to wildlife and its essential habitat than has already been done. Much effort has been made both individually and as members of organized action groups and by members of your committee to prevent destruction of bird life and its environment. This, we fully realize, is largely a rear-guard delaying action and is not enough, even though it is important.

Dynamic Action Needed

Professional ornithologists, interested, though casual, bird watchers, and naturalists generally constitute the segment of our citizenry most concerned when practices and influences deplete our bird populations. It seems not illogical, therefore, that this group should be articulate and positive in expressing itself and in doing something about any situation that destroys bird life and its habitat. Democracy is safest when citizens accept their obligation for tactful but dynamic and positive action that is in the best public interest. As the senior ornithological organization on this continent, the A.O.U. and its respective members might, therefore, be expected to do more than passively document the problems and situations that adversely affect our birds. An objective review of the past might suggest that we have done little more than this, although many of our members, working as private individuals and with action

groups, have been among the most effective workers in protecting birds and improving their environment.

Each member of the Union, we feel, should do his utmost to protect local birds and habitat areas in his neighborhood. Local strategic areas should be secured as public property or purchased by a bird group or organization to insure that essential local habitats are permanently secured for endangered or specialized groups of birds. The penalty of delaying specific action is well illustrated by the Stone Harbor, New Jersey, heron rookery. This 31-acre tract, that has in it virtually every species of North American heron, along with the Glossy Ibis, was tax delinquent and was foreclosed by the community not many years ago. Now this tract is valued at $500,000!

Tule-Klamath Wildlife Refuges

During the past year effort has continued by land-grabbing groups to try to despoil and take over important wildlife refuge areas and use them entirely for agricultural purposes. An irrigation district in the Tule-Klamath area of southern Oregon and northern California under agreement had been given the operation of this sump basin. Obviously, in an attempt to ruin these great waterfowl refuges (probably the most important in the United States), the water level was dropped and held at the minimum low in order to drive the waterfowl away and then make the area available for agriculture. With courage and forthright action Secretary Seaton of Interior took control out of the hands of the irrigation district, and water levels were restored.

Padre Island

The membership will be glad to know that President Lowery in the name of the Union sent a strong and effective appeal to the Senate Investigating Committee looking into the merits of the Padre Island seashore area of coastal south Texas. Nearly all of this 117 miles of sandy Gulf beach and coastal marshes attracts many species of birds. It is certainly in the public interest that this area be protected and be permitted to retain its unique attractiveness. This positive appeal has helped considerably in winning public support for the area. The proposed Cape Cod, Oregon Dunes, and perhaps other areas merit equally effective support.

Albatross

President Lowery and various members of your committee, along with many other ornithologists and other private citizens, protested the pro-

posed order of the Navy to slaughter the albatross in certain units of Midway Islands because the birds had become a hazard to the important military air base there. The air base was constructed in the midst of the birds' ancestral and firmly established nesting grounds. We protested the cruel slaughter and suggested more effective study be given the problem and alternative approaches sought. It was feared that such slaughter of these confiding and interesting birds might result in complete extermination of another majestic member of our avifauna. The protests have caused the Navy to rescind the premature and unnecessary order.

Waterfowl Situation

An early August report from the U.S. Fish and Wildlife Service shows that, while nesting habitat for American waterfowl was somewhat improved over the unfavorable conditions of a year ago, the situation is still far from satisfactory and there is "no reason for real optimism that ducks are on the upward trend this year." The Service report indicated that restrictions of the past hunting season decreased the kill of ducks by 42 per cent or approximately six million birds. Even so, the breeding population seemed to be down about one fifth over last year's low, which means there are still a lot of vacant nesting homes for ducks even in the most favored areas. The situation is most serious with some of our inland divers, particularly Redheads, Canvasbacks, and Ruddy Ducks. The first two species are now placed on the fully protected list for this year in the United States. The Canadian hunting regulations limit the take of Redheads and Canvasbacks to one in the bag or one in possession. We hope the gunners can identify them. The improvement in water conditions should reflect some increase in populations of some species by now. A press release just received indicates that we may expect about the same populations this coming season as last year except in the Pacific flyway where the situation has worsened somewhat.

Illegal and outlaw trapping and market hunting is reported to continue to be serious in some extensive marsh areas of the United States. Here informed local citizens believe the illegal take exceeds the legitimate harvest. It is to be hoped that administration will concentrate enforcement at those times and places where best results can be expected and where the more flagrant violators can be brought to justice.

Rare and Vanishing Species

Whooping Cranes, 33 in number and consisting of 31 adults and 2 juveniles, utilized the Aransas National Wildlife Refuge and adjacent areas this past winter (1959–1960) from mid-October to late March and

early April. Two adults obviously with no urge or opportunity to nest could see no point in the long migration, so are spending the summer on Matagorda Island. Some improvement over last summer in nesting in the far north is reported, as at least four pairs of birds are known to have one young each. If history repeats itself, we may yet have one or more young to add to this summer's known production when migration gets under way. The membership may have seen accounts that a railway may be constructed near the known nesting grounds of the whooper in the Northwest Territory of Canada. Canada's Minister of Northern Affairs has given assurance that the tracks will bypass any nesting area. While this might still seem a threat, the difficulty of summer travel in this great muskeg region would seem to minimize any serious danger.

The six whoopers in captivity (five adults at the Audubon Park Zoo, New Orleans, Louisiana, and one at San Antonio Zoo, Texas) show no increase. Josephone and Crip, the parent cranes at New Orleans, hatched two chicks from five eggs laid this spring. Three eggs were infertile. Unfortunately both young died, one when only one day old and the other at 17 days old. It then stood 12 to 14 inches high and apparently died of a lung infection. It is unfortunate, and we believe contrary to the public interest that all of these captives continue to be held in one place. Certainly the San Antonio bird cannot reproduce without a mate! Most of us have more interest in the wild birds than in those in captivity. However, with such a majestic species (our largest and most publicized wading birds) so precariously close to oblivion, it would seem that more effective action would be taken and some of the New Orleans birds sent elsewhere in the hope that the species can be saved from extinction.

The Nene Goose or Hawaiian Goose in captivity probably has been handled most of the time with more skill than has the captive whoopers, and, while their status is still far from satisfactory, the bird is breeding fairly well in captivity on the Hawaiian Islands and at the Wildfowl (Severn) Trust in England. In 1958–1959 nine nests were found, and 11 young were produced in the wild. Possibly because of volcanic activity only one nest in 1959–1960 was found, and no young were produced. At a special game farm on the Island of Hawaii the Nene is propagated. Following the last breeding season, 19 birds were moved to an open-top pen where release was desired with the hope that following the molt the birds would be well acclimated and would fly out and establish themselves in this part of their ancestral range. The bird is the subject of an extensive ecological study in Hawaii. Effort is being made to liberate the birds on Maui Island where it formerly occurred.

Recently a convincing, and probably accurate, but still unconfirmed

report of a pair of Ivory-billed Woodpeckers in East Texas has been received. It seems advisable to determine the accuracy of this before reporting details.

Large Wading Birds

Concern has been felt for several years for the future of some of our larger wading birds—herons, ibises, egrets, spoonbills, etc. According to the accumulated records of the Audubon Society, most members of this interesting group fared a little better than average this past season. Some, like the picturesque Roseate Spoonbills and the Wood Ibis, or Wood Stork, which have been alarmingly scarce for many years, have shown a most encouraging increase. The Glossy Ibis also has fared well, as have most herons and egrets. However, the Reddish Egret, for reasons unknown, has shown a rather alarming decrease. A study of this species is needed.

The Grouse Family

(In part condensed from a summary report by Dr. F. N. Hamerstrom, Jr.)

The current status of North American grouse is primarily determined by man's use of the land. Consequently, with land abuse and with intensive agriculture, some species of grouse are in a precarious condition because they are not very adaptable and cannot adjust if their favored environment is appreciably altered. The ptarmigan, which are species of the far north and high mountains, are widespread and successful, and it is not likely that much of their habitat will be seriously altered by man.

The forest grouse are much more influenced by man because of clearing, lumbering, and fire. In wilderness areas they have been affected but little. Blue Grouse are probably more abundant than in presettlement times. Lumbering and fire have increased their breeding range. Their habit of nesting on the lower slopes and migrating up the mountains for winter causes scattering and makes them generally less available and harder to bag. The Spruce Grouse is uncommon now in many areas, but its ecology, life history, and population dynamics are not well understood. Research is needed on this species.

In much of its range the Ruffed Grouse is probably more abundant than it was in presettlement times. Because it is a bird of the clearings and edges and young stage forest succession, its habitat is improved by many but not all forestry practices. It is, therefore, most abundant in rather close proximity to man and is perhaps our most important forest game bird.

The grouse that have suffered most at the hands of man are those whose restricted habitat is most valuable for farming and intensive grazing. In this there is no absolute distinction along species lines, as Ruffed Grouse have been driven out of most of the belt of deep hardwood soils that lie to the east of the prairies. The three northern sharp-tailed races have scarcely been affected by civilization, while the three southern races have been seriously depleted.

The prairie grouse, including the prairie chickens, Sharp-tailed Grouse, and Sage Grouse, generally have suffered most at the hands of man. The heath hen became extinct in 1932. The Attwater Prairie Chicken certainly is on the skids, and only a change in land management or a series of well-managed refuges of considerable size can save it. And this will have to come soon. With the plowing of the coastal prairie grasses, its range has melted away like an ice-cream cone in the hands of a hungry boy. Its former range limited largely to Texas extended along the coast from Corpus Christi Bay a short distance into Louisiana and inland as far as Austin and the Edwards Plateau. By 1937 the bird had lost nearly three-fourths of its former range and then existed in a series of disjunct and largely isolated patches within the original periphery. By 1960 the colonies or disjunct populations are very much smaller and more isolated. A number of counties have lost all their birds, and others have only a few small colonies. It is doubtful that the present population is over 3 to 5 per cent of what it was 30 years ago. The need is a concerted effort to buy range habitat and more effectively use and manage all suitable public land within its present range.

Like the Attwater, the Greater Prairie Chicken is dependent upon grassland. Plowing for farming and overgrazing have both been effective in removing this race. These widely distributed birds are now found sparingly in about 15 per cent of their former range. Where grazing is less severe, they seem to be making good recovery. Dictated by economics, the grazing regimen of "take half and leave half" is found to be a satisfactory standard that is best for the cattlemen and that favors the prairie chicken as well. Because of the importance of this species, Indiana, Michigan, Wisconsin, Missouri, and Minnesota have recently purchased land for management of these and other game species. Perhaps equally as encouraging, private resources have contributed to the purchase of many acres of additional land to save and manage the Greater Prairie Chicken. Many federal as well as state refuges are now being managed more and more to benefit these birds.

The Lesser Prairie Chicken continues to hold on in its small ranges in the arid southwest. The species requires both grassland and some brush.

Overgrazing here is more serious than is farming. The excessive use of herbicides in brush removal and payment of federal subsidies for land clearing are new threats in places to this species. New Mexico has bought and leased well over 23,600 acres to manage more effectively this species. It is hoped that Kansas may follow a similar course.

Less is known about the ecology of the Sharp-tailed Grouse. The Columbian sharptail of the west has been seriously affected and restricted both because of overgrazing and agricultural practices. The two other southern races are in much better condition. The Sage Grouse has lost about one half of its former range and much of its present distribution is on public lands in the sage brush belt of the west. Sound management and the prevention of overgrazing should insure the increase and perpetuation of this species. The need to save all our grouse species is definitely dependent upon our ecological understanding and ecological conscience.

Rediscovery of Hawaiian Bird

Based on newspaper accounts in the *Honolulu Advertiser* of 28 July 1960, the *Honolulu Star-Bulletin* of 27 July 1960, and on personal correspondence, it appears that a rare bird on the wet island of Kauai thought to have been extinct for 60 years has again been discovered by Dr. Frank Richardson of the University of Washington and John Bowles, a local school teacher. The bird is the Ooaa or Moho *(Acrulocercus braccatus)*. Several birds were seen near a large swamp. A number of other rare birds were also found in this secluded area.

It is gratifying to learn that with support from the Hawaiian Board of Agriculture a study of Hawaiian birds is under way. The Hawaiian Conservation Council points out the urgent need for sanctuaries on the islands. It points out that because of excessive drainage on the various islands the Hawaiian Gallinule has already largely disappeared from its former haunts on Oahu and that the bird is likely to become extinct at least on this populous island unless sanctuary and habitat are soon provided.

We are informed that a two-year detailed life history and management study of the Hawaiian Duck is to be undertaken on the Island of Kauai. A similar study is needed on the Hawaiian Crow, as it continues to decrease and may soon be added to our extinct fauna.

A major threat to native forest birds will result if the proposed plan to "re-zone" forest areas is carried out. This proposal is to convert the native vegetation into timber-producing crops. Certainly this shows the need of establishing wilderness areas or sanctuaries for native plant and animal life on these islands.

Hawaii is now a land of exotics. More foreign birds and mammals are still being introduced. Some of these introductions have had an adverse effect on the unique endemics of the Islands, and more adverse effects can be expected in the future.

Bird Introductions

During the past year renewed attempts were made to introduce more exotic birds into the United States. Pastures always seem greener farther away. Attempt was made to bring in European robins and obviously with little knowledge or awareness of previous attempts that had proved unsuccessful. Your committee strongly advised against promiscuous introductions unless previous competent studies showed the unmistakable need of some foreign bird to fill a niche that currently was not occupied, and further that there was little likelihood of the introduction eventually proving to be more of a liability than an asset. The Fish and Wildlife Service deserves credit for disapproving the requested introduction.

The International Scene

(With help from Jean Delacour, Hoyes Lloyd and several others.)

It is gratifying to report the successful Twelfth Conference of International Council for Bird Preservation held in Tokyo, Japan on 24-29 May 1960. The U.S.S.R., Korea, and Belgian Congo were the latest additions joining this council. Many countries were represented at this international meeting. Resolutions adopted urged more sanctuaries and called attention to dangers in Antarctica from release of sled dogs, discharge of oil, and interference with native fauna. The World Health Organization was wisely advised to deal with pesticides because of ignorance regarding biological effects including the danger of mutant insects and other organisms. It urged that Japan be the center for study and protection of migratory birds in Asia and Pan-Pacific areas. It also proposed that Pan-Pacific countries should conclude conventions to protect migratory birds and that countries in Asia, particularly India and Russia, should do likewise.

It urged that the Nene be made the state bird for Hawaii, and we understand that strong effort in Hawaii to accomplish this is well under way. Other countries were advised to choose state birds to make people conscious of the value of bird life. It was also recommended that birds have a special place in the program of the World Forestry Congress in 1960.

Oil pollution at sea was reported to be a continuing problem and

source of great destruction to bird life. Countries were advised to support the proposed international convention to minimize this problem.

Hoyes Lloyd appropriately calls attention to the fact that this World Council grew from the A.O.U. Bird Protection Committee as reported in *The Auk* of October 1884 via the efforts of T. Gilbert Pearson and others in 1922. Pearson at that time was a fellow of the A.O.U. and President of the National Audubon Society.

Grand Rapids Power Project

In the so-called march of progress we may expect that some great developments may adversely affect wildlife. The proposed Grand Rapids Power Works may largely destroy the great Saskatchewan River delta marshes from the Pas to Moose and Cedar lakes, Manitoba. Those who know these great waterfowl marshes class them as among the very best on this continent. That this represents a prime breeding area makes the situation doubly serious for migratory waterfowl. It is to be hoped that through a cooperative study by competent wildlife biologists and engineers most of this damage can be averted. If these great delta marshes are destroyed, this will be a catastrophe.

The Drainage Craze

Water is the lifeblood of a nation; consequently, it should be used and managed wisely and not wasted. Certainly there are times when drainage is necessary and in the public interest. Where water is in short supply, water management rather than drainage should be the criterion. While we heartily support the full right of free enterprise and the public responsibility that goes with this, we do not believe drainage, per se, should become a political football nor a selfish means of cruel exploitation at public expense.

Subsidized drainage as it has become in some parts of the Prairie States is of questionable biological value and is a paradox in governmental administration. Certainly this drainage of potholes is doing irreparable damage because it is fast destroying the most essential and best waterfowl nesting habitat in the United States. A few facts may put this problem in perspective:

1. As of April 1959, the U.S. Commodity Credit Corporation, the price support arm of the United States Government, reported it had approximately $9 billion invested in the price support program. Before the beginning of the new harvest it then had on hand 1,084,090,690 bushels of wheat in storage.

2. The same Department of Agriculture through its field employees

and subsidy was encouraging farmers to drain their potholes and was financially supporting the drainage. This would raise more grain for an already glutted market for which it would pay price supports and pay for storage for a pyramiding surplus.

3. In these same drainage areas the same Department was paying millions of dollars for the Soil Bank Program to take land out of production.

4. Also payments were being made in these same areas to build farm ponds.

5. A sample survey some two years ago revealed that 48.1 per cent of the acreage of wheat or agricultural land brought into production in the Prairie States was drained in violation of the Department's stated policy of not bringing new land into production.

6. Another arm of the same government is urgently buying waterfowl refuges in these same counties of the Prairie States to save waterfowl habitat.

7. Both federal law and international conventions obligate the government to protect and support our waterfowl and the resources connected with it.

The Growing Pesticide Problem

Chemical warfare against pests, insects, mites, fungi, disease, obnoxious plants, and rodents has become so widespread, so commonplace, and so promiscuous that it threatens the well being of man and society as well as bird life. Controls wisely and skillfully used are in the public interest and were developed in response to a public need. Improperly and extravagantly used, they are doing serious damage to wildlife. Only time can tell what injury may befall our citizens because of their misuse and overuse.

Well over 12,500 brand name formulations and more than 200 basic compounds are now on the market for the uninformed public to buy and use as it pleases. Big business, high-pressure salesmanship, and even government agencies have fostered public demand for control. Probably three billion pounds of dry and liquid chemicals are sprayed annually in the United States on over 100,000,000 acres of crops and timber land. In many places this has been damaging to bird life.

Despite the brazen statements from some pesticide manufacturers, salesmen, operators, and from too many officials in the control arm of government that no significant damage has or will result, there is an ever-growing array of facts indicating that serious damage in local and sometimes extensive areas is occurring. The indirect and long-term effects of all poisonous pesticides are imperfectly known, but enough

facts on a few of the more common pesticides (not including the more poisonous) give warning that it is the point of wisdom to be cautious and careful and keep control to a minimum until more facts are known.

The cranberry episode of last Thanksgiving and the ruling of zero tolerance of various pesticides in foods, particularly in milk, milk products, meats, and vegetables by the U.S. Food and Drug Administration should give convincing evidence that the dangers to human health may be real and serious. If these poisons are dangerous to humans who have every protection, isn't it likely that birds and animals in the wild that subsist much more heavily on foods that have been sprayed would be affected?

Despite claims to the contrary by some control workers and some officials of the control arm of the United States Government, considerable unimpeachable data are now accumulated showing that some control operations have been unnecessarily damaging to other interests, particularly wildlife. After three years some quail populations have not yet returned to pretreatment levels nor to population level of quail on comparable untreated areas, in the same type of habitat. Probably most control has been well handled, but during the past few years there has been a growing tendency on the part of some control groups to give little or no consideration to other national or local interests and values. It is exceedingly unfortunate that dangerous toxicants are being used in excessive quantities on a huge operational scale without adequate research to guide such use. Probably the fire ant "eradication" program of the Southeast United States, under the United States Department of Agriculture, is an example of this. The program is supposed to be fully cooperative. In the nine states where this mislabeled "eradication" operation has been carried out since 1957, most of the states have either refused to contribute or after two years have withdrawn all or most of their financial contribution.

As further evidence that this program has not been on a very high scale of efficiency or at least has not given satisfaction, it may be reported that the program has been unanimously condemned by both the Southeastern Association and the International Association of Fish, Game and Conservation Commissioners as being unnecessarily destructive and uncooperatively directed and without due consideration of other interests. It is also of interest to note that the resolutions of those responsible organizations encouraged the submission of a Congressional bill requiring that pesticide programs be coordinated with wildlife interests in the federal and state services.

We need pest control, but it is imperative that it be guided by responsible and objective leadership and that other interests be appro-

priately coordinated with the objectives of control. There is urgent need that big operational programs be preceded by an adequate degree of competent research on the effects of the poisons on man and his domestic and wild animals and birds. The minimum rather than the maximum dosages should be used. There is great need to develop specific control agents of minimum satisfactory toxicity rather than to strive constantly to obtain ever more toxic broad spectrum poisons. Every effort should be made to use biological and cultural control wherever they can be successful. The philosophy that "if a little is good, more control must be better" has no place in a sound control program.

DAVID A. MUNRO
RICHARD H. POUGH
H. ALBERT HOCHBAUM
ROBERT A. MCCABE
IRA N. GABRIELSON
CLARENCE COTTAM, *Chairman*

GENERAL NOTES

Relationships of the Cinereous Harrier.—The Cinereous Harrier of South America usually had been regarded as a species, *Circus cinereus*, until Hellmayr and Conover (1949, *Birds of the Americas*, pt. 1, no. 4, p. 221, footnote) made it a race of the species *Circus cyaneus*, called Marsh Hawk in America and Hen Harrier in England. The range of the Marsh Hawk does not extend south of Virginia in the east and Oklahoma and northern Baja California in the west, whereas the Cinereous Harrier ranges north only to Ecuador and, perhaps casually, Colombia. Furthermore, the latter, unlike the Marsh Hawk, becomes a mountain bird in the more northern part of its range. It is common at elevations of 12,000 feet in Ecuador and near Lake Titicaca. In Argentina, the southern part of its range, it occurs at sea level. When birds whose ranges could meet geographically are nevertheless separated by 1,500 miles or so, one suspects that they have been separated for a long time and are, in fact, distinct species. Admittedly, some of the intervening terrain is not very suitable for harriers, but much of it, and at varying elevations, is. The presence of another harrier, the well-marked species *C. buffoni*, in South America shows that the genus is not a newcomer there.

Hellmayr and Conover overstate the similarity between these two harriers. The adult male of *cinereus* has the under parts posterior to the chest, boldly and conspicuously barred with deep rufous brown. In the adult male of *C. cyaneus hudsonius*, on the other hand, the under parts in this area are mostly whitish with sparse, rufous check marks, and only in occasional specimens is there, except on the sides, a suggestion of barring, and even then it is very much less conspicuous than in *cinereus*. More important, *cinereus* is one of those harriers, like *C. assimilis* of Australia, in which the female also has an advanced type of plumage, quite unlike that of the immature. This plumage of female *cinereus* is similar to that of the adult male, but the ventral barring is somewhat coarser and extends all the way up to the chin, while the upper parts are much browner, less glaucous, the glaucous-gray cast being chiefly limited to the wings and tail, and even there less noticeable than in the adult male. The immature plumages also are separable from those of *hudsonius*, though the differences are less marked, and perhaps occasional birds may be difficult to tell apart except by the smaller size of *cinereus*. One immature female from Patagonia seems much like some adult females of *hudsonius*, but the upper parts are somewhat darker. The above evidence, viewed in terms of the relatively slight differences separating some species of the genus *Circus*, leads me to conclude that *cinereus* has probably reached the specific level of differentiation. I suggest, therefore, that we revert to the practice of calling it a species.

Parenthetically, one may note that it is by no means certain that the Old World "Hen Harrier," *cyaneus*, is conspecific with the North American Marsh Hawk, *hudsonius*. The females are very similar; but the male of *cyaneus* is immaculate gray and white, and the immatures are rather different also. Probably it is best to leave them as conspecific, as has been done in such conservative works as the A.O.U. *Check-list* and Peters' *Check-list*. One may merely call attention to the fact that it is necessary to guess, since the ranges of the two do not meet.

While examining these birds, I noticed a specimen of *Circus cyaneus hudsonius*, the North American Marsh Hawk, collected at Merida, Venezuela, on 14 December 1903 by Gabaldon and Sons, the professional collectors who sent an incredibly

large number of birds of prey from this area to museums the world over. This bird, formerly in the Jonathan Dwight Collection of the American Museum of Natural History, has been presented to the Phelps Collection in Caracas. It was apparently never recorded in the literature. The species has wandered to Colombia two or three times on winter migration, and so its occurrence in Venezuela is not too unexpected.—DEAN AMADON, *American Museum of Natural History, Central Park West at 79th St., New York 24, New York.*

Notes on Fossil Tinamous.—The genus *Tinamisornis* provides the earliest record of the structurally primitive family Tinamidae. Cayetano Rovereto (Los estratos Auracanos y sus fósiles, *Anal. Mus. Nac. Hist. Nat. Buenos Aires*, 25: 161, 1914) set up the genus to include two new species of tinamous from the Pliocene of Monte Hermoso, Argentina, without designating either as type. This omission is now rectified by the selection of *Tinamisornis parvulus* Rovereto as type of the genus.

The cotypes of *T. parvulus* consist of a left coracoid, right humerus, right carpometacarpus, and tarsometatarsus. The right humerus is hereby designated as lectotype of the species.

The second species described by Rovereto, *Tinamisornis intermedius*, is generically distinct. Its humerus differs from that of *T. parvulus* in being stout and relatively straight. The bicipital crest is without the distally hooked deflection present in *T. parvulus*. The distal end is very wide, 70.9 per cent of the proximal width, compared with 61.5 per cent in *T. parvulus*. The ectepicondylar prominence is strongly produced and rounded, with the entepicondyle flaring. *Tinamisornis intermedius* is therefore separated as the type of a new genus, to be known as ***Roveretornis.***

The original series of *Roveretornis intermedius* (Rovereto) consists of the holotype ("tipo") left humerus, paratype ("tipo complementario") pelvis, referred proximal portion of a tibiotarsus, and referred distal portion of a femur (erroneously termed a tibiotarsus; see Lambrecht, *Handbuch der Palaeornithologie*, p. 223, 1933). The doubtfully referred distal portion of a tarsometatarsus ("tipo?" illustrated in Rovereto, *op. cit.*, pl. 25, fig. 2d) appears to represent *Tinamisornis parvulus*. Because of the somewhat loose manner in which Rovereto designated his types, and because two species are involved in the type series, the left humerus is hereby selected as lectotype.—PIERCE BRODKORB, *Department of Biology, University of Florida, Gainesville, Florida.*

On the Supposed Nesting of the Rhinoceros Auklet near Metlakahtla, Alaska.—In the preparation of a forthcoming catalogue of sea-bird colonies in British Columbia (Drent and Guiguet, Occ. Pap. B.C. Prov. Mus., No. 12), I frequently referred to Gabrielson and Lincoln's excellent new book, *The Birds of Alaska* (Wildl. Mgmt. Inst. and Stackpole, Washington and Harrisburg, Pa., xiii + 922 pp., 1959). In discussing the Rhinoceros Auklet *(Cerorhinca monocerata)*, these authors state (p. 512) that, in addition to the two definitely known colonies in Alaska (St. Lazaria and Forrester), "According to Bent, an egg of this species in the Collections of the Geological Survey of Canada was taken in June 1907 on Lucy Island near Metlakahtla, by the Rev. J. H. Keen." Reference to the appended gazetteer (compiled by M. A. Putnam) shows that this means Metlakahtla, Annette Island, southeastern Alaska.

Mr. F. Glinn, present lightkeeper at Lucy Island, British Columbia (the largest

of a tiny islet cluster, 54° 17′ 40″ N, 130° 35′ 29″ W), reported Rhinoceros Auklet nesting there now, in response to a questionnaire (via G. C. Odlum, 1 March 1960). Lucy Island, B.C., lies about 20 kilometers (12 miles) west of Prince Rupert, and about 13 kilometers (8 miles) west of Metlakatla, B.C. (old spelling "Metlakahtla"; located on Tsimpsean Peninsula). It occurred to me that Keen's record cited above might in reality apply to this Canadian island, confusion arising from the two Metlakatlas. Large (*The Skeena, River of Destiny*, Mitchell Press, Vancouver, ix + 180 pp., 1957) relates (pp. 20–22) that W. Duncan, an Anglican missionary, founded the original (B.C.) Metlakatla in 1862, but that in 1887, owing to differences with the newly appointed bishop, he moved to a site on Annette Island, Alaska, some 70 miles northwest, and there established "New Metlakahtla" (the h is usually retained); thus came about the duplication of place name. Examination of the U.S. Coast Pilot (*Southeast Alaska, Dixon Entrance to Yakutat Bay*, 10th edition, Washington, GPO, 1952) failed to disclose a Lucy Island near the Alaskan Metlakahtla.

Dr. Gabrielson writes me (*in litt.*, 7 November 1960) that, although no Lucy Island could be found for the Alaskan area in question, he and F. C. Lincoln included the record, albeit with reluctance, since they had found that many old place names could no longer be traced. Mr. W. Earl Godfrey, Curator of Ornithology at the National Museum of Canada, has kindly informed me (*in litt.*, 27 October 1960) that Keen's egg bears the number 874 in the egg catalogue, and was collected, according to the label, in June 1907 on Lucy Island, near Metlakatla, British Columbia. It was received at the museum in 1908.

The Reverend John Blewett, Principal, Anglican Theological College of B.C. (Vancouver), was good enough to review the records, and reports that Reverend J. H. Keen was Anglican clergyman at the settlement of Metlakatla, B.C., from 1899 to 1913. The eight years preceding, he was engaged in missionary work at Masset, in the Queen Charlotte Islands (see Keen, J. H., *Ottawa Nat.*, 22: 260, 1909), and through this long experience became an authority on the birds of his region. Thus Fannin (on p. 13 in *Check List of British Columbia birds*, pp. 13–57 in a preliminary catalogue of the collections etc., Prov. Mus., Victoria, 1898) and Osgood (on pp. 8–9 in *Natural History of the Queen Charlotte Islands*, U.S. Dept. Agric. Biol. Surv. N. Amer. Fauna No. 21, 50 pp., 1901) thank Keen for use of his Masset bird records; and Kermode (*Catalogue of British Columbia birds*, Prov. Mus., Victoria, 69 pp., 1904) draws heavily on the notes of "Rev. J. H. Keen, Queen Charlotte Islands and Metlakatla" (acknowledgment p. 3). Further, Mr. Godfrey brought to my attention that Keen published "Bird migration in northern British Columbia" (*Ottawa Nat.*, 24 (7): 116–117, 1910), the data covering the years 1900–1910 inclusive, for the Metlakatla, B.C., region.

In summary, there appears to be no doubt that the egg record for the Rhinoceros Auklet given by Gabrielson and Lincoln (*op. cit.*, p. 512) for a Lucy Island, west of Metlakahtla, Alaska, in reality refers to Lucy Island, British Columbia (54° 17′ 40″ N, 130° 36′ 29″ W). To Reverend J. Blewett, Dr. I. Gabrielson, Mr. W. E. Godfrey, and Mr. G. C. Odlum (for Mr. F. Glinn), who so readily responded to my inquiries, I render my sincere thanks.—RUDOLF H. DRENT, *B.C. Nest Records Scheme (from which this constitutes contribution No. 3), Department of Zoology, University of British Columbia, Vancouver 8, Canada.*

Specimen of the Yellow-green Vireo from Texas.—While identifying the vireos in the H. H. Kimball collection, taken principally in the southwestern United

States, I discovered a specimen of the Yellow-green Vireo *(Vireo flavoviridis)* taken by Mr. Kimball on 9 May 1938. Unfortunately, there is no locality given on the original label. After checking through old correspondence both to and from Mr. Kimball, it appears that he spent the years 1935 to 1944 in Matagorda, Matagorda County, Texas. Although it is impossible to state with certainty that the bird was collected there, it seems from statements by Mr. Kimball and others that he did not travel much when established in a locality, especially in his later years.

In his summary of the literature, Monroe (*Auk*, 76, 1959: 95–96) lists three other specimens from the United States.—Larry L. Wolf, *The University of Michigan Museum of Zoology, Ann Arbor, Michigan.*

Another Probable Record of an Eskimo Curlew on Galveston Island, Texas. —At 4 P.M. on 3 April 1960 Mr. Carl H. Aiken III, Mr. Stephen G. Williams, and I observed, at a distance of about 150 meters, what we identified as an Eskimo Curlew *(Numenius borealis)* among four Whimbrels *(N. phaeopus)* in a pasture on Galveston Island. We studied the Eskimo Curlew for two minutes through a Bushnell 25x spotting scope and a 30x Balscope before it flew out of sight down the island. A little later Mrs. Jerry B. Strickling drove up and informed us that her party had found an Eskimo Curlew in a nearby pasture. Mr. and Mrs. Strickling, Mr. and Mrs. Henry S. Hoffman, Aiken, Williams, and I studied this bird at leisure in excellent light through the spotting scopes at a distance of 300 meters. It fed on well-drained ground where the grass was about eight cm. high. A Golden Plover *(Pluvialis dominica)* and a Long-billed Curlew *(N. americanus)*, feeding nearby, were observed several times with the Eskimo Curlew in the field of the scope.

The most striking marks of the bird in question were the very thin, short bill (the Whimbrel is a decidedly thick-billed bird), the small size (about that of a Golden Plover), and the general buffy coloration. The buffiness was most prominent on the crissum and lower abdomen, but the feathers of the back and the secondaries appeared to be edged with buff, giving the bird an over-all darker appearance than that of the Whimbrel. The hind neck and back were delicately streaked. The crown appeared uniform brown with a thin, indistinct, medial stripe. The line through the eye was brown and the superciliary line light buff.

During April 1959 I studied on four occasions the Eskimo Curlew reported by George G. Williams (*Auk*, 76: 539–41). The Stricklings also saw the Eskimo Curlew reported by Williams. The possibility must be considered that the bird we identified as an Eskimo curlew could have been a Least Curlew *(N. minutus)*, since the two species are almost identical in the field. However, as Williams noted in his article, the Least Curlew is an Asiatic-Australian species that has never been recorded in North America and is most improbable in spring in southern Texas. The possibility also exists that the bird in question was an abnormally small Whimbrel, but I believe this is highly unlikely since it possessed characters such as buffy coloration and a very thin beak, which the Whimbrel lacks. Within these limits of probability, I am convinced that the bird I saw on 3 April 1960 was an Eskimo Curlew. All observers mentioned here concur in this identification.

The fact that a curlew pronouncedly smaller than a Whimbrel and with a much shorter and thinner bill was observed on Galveston Island in two successive years heightens the probability that this bird was an Eskimo Curlew rather than a Least Curlew.

After 3 April, despite intensive search of the area for almost two weeks, the bird was reported on only two other occasions. On 4 April Mr. Armand Yramategui reported an Eskimo Curlew in the same pasture where the Stricklings and I had seen it the previous day. Mrs. J. A. Snyder and Mr. Clinton Snyder reported an Eskimo Curlew in the same pasture on 6 April and compared it with Whimbrels and Long-billed Curlews. They also reported that the bird had reddish-cinnamon axillars and under wing coverts. This observation lends further substance to the identification of the bird as an Eskimo Curlew, rather than a Least Curlew, since Ridgway (*Birds of North and Middle America*, 1919, p. 411) lists the only plumage difference between the two species as the cinnamon-buff axillars and under wing coverts of the Eskimo Curlew, in contrast to the pale-buff axillars and under wing coverts of the Asiatic bird.—Victor L. Emanuel, *2607 Tangley, Houston, Texas.*

Two Unusual Bird Records for California.—On 18 September 1960 Dr. Francis X. Williams, Associate Curator of Entomology at the Natural History Museum, picked up a dead Worm-eating Warbler, *Helmitheros vermivorus*, on the street at 3rd Avenue near the City Park in Chula Vista, San Diego County, California. The bird was still warm, and the fractured tip of its beak gave evidence of its having struck a solid object, in all probability a window pane. The specimen, an immature male, is Number 30219 in the collection of The San Diego Society of Natural History and represents the first record of this species for California.

On the same date a specimen of Red-breasted Goose, *Branta ruficollis*, was shot by a hunter near Carlsbad, San Diego County, California. This small goose was feeding in a pond on the Kelley ranch when collected and was brought to the museum by Mr. H. C. Kelley, Jr., who had recognized it as a very unusual bird. The specimen, an immature male, was in very thin flesh when prepared as a cabinet skin and is now Number 30220 in the collection of the San Diego Society of Natural History.

The capture of this goose so far from its native range in Middle Siberia offers some question of its origin. However, the flight feathers show evidence of considerable use, and the body plumage, in a state of partial moult, is in clean condition, which would not have been so with a cage-reared bird, nor is it probable that a cage bird would have been in such thin flesh. The date of capture also closely correlates with the southward migration of northern waterbirds. In all probability, this Red-breasted Goose had strayed eastward from its normal range and followed or joined the North American migrants on their southward journey. The capture of this bird represents an additional species to the North American list and a new bird for California.—Laurence M. Huey, *Natural History Museum, Balboa Park, San Diego, California.*

***Somateria mollissima v. nigra* in Minnesota.**—In late October and early November 1959 Minnesota was apparently invaded by a small flight of Common Eider. Two were shot 25 October near Warroad, Roseau County, on the south shore of Lake of the Woods. Dr. John Larson of Warroad kindly sent one specimen in the flesh and the skin of the other to the University of Minnesota Museum of Natural History. A third was shot from a flock of seven ducks 6 November at Squaw Lake, Itasca County. The partially plucked specimen was obtained by Minnesota Warden Robert Greig and forwarded to Lee who presented it to the Museum. The Warroad specimens (MMNH 15812 and 15813) and the head and feet of the Squaw Lake bird (MMNH 16400) were sent to W. Earl Godfrey of

the National Museum of Canada, who identified all three birds as the race *v. nigra*. These are the first specimens of the Common Eider taken in Minnesota. An earlier sight record of Common Eider by William Pieper at Grand Marais, Cook County, 7 November 1955 is considered valid.—Robert W. Dickerman, *University of Minnesota, Museum of Natural History, Minneapolis, Minnesota*, and Forrest B. Lee, *Minnesota Division of Game and Fish, St. Paul, Minnesota*.

Aggressiveness of Migrant Myrtle Warblers toward Woodpeckers and Other Birds.—In making observations on woodpeckers over the course of eight years in the vicinity of Seneca, Maryland, I have noted repeated instances of attacks made on them, as well as on other birds, by migrant Myrtle Warblers *(Dendroica coronata)*. These attacks have taken place in October and November. On 9 November 1957, for example, a Red-bellied Woodpecker *(Centurus carolinus)* with something yellow in its bill, possibly a piece of acorn, was swooped at and closely pursued by a Myrtle Warbler as it flew across a canal. I have witnessed similar attacks on Red-headed *(Melanerpes erythrocephalus)*, Hairy *(Dendrocopos villosus)*, and Downy *(D. pubescens)* woodpeckers, as well as on Bluebirds *(Sialia sialis)*, all occurring in mid-air. The frequency of such episodes may be indicated by observations made in 1960. Thus, on 20 November I saw a Myrtle Warbler attack a Downy Woodpecker that was feeding on poison ivy berries *(Rhus radicans)*. The Downy flew across the canal with the warbler in pursuit, both rested in a tree within a short distance of each other, and the warbler resumed the attacks when the woodpecker took wing again. This sequence happened three times. While standing at the same spot a few minutes later, I observed a similar series of attacks on a Chickadee *(Parus carolinensis)*, which had a poison ivy berry in its bill; on a Blue Jay *(Cyanocitta cristata)*, which was driven from an oak; and on a Cardinal *(Richmondena cardinalis)*. On 27 November I observed Myrtle Warbler attacks on a Downy and a Hairy Woodpecker and finally on a Robin *(Turdus migratorius)*. This last episode was unusual. The Robin refused to leave the limb on which it was perching except to fly at the Myrtle Warbler three times.

Factors common to many episodes, such as those described above, were that the birds either had food in their bills or were close to a poison ivy vine covered with berries. The warblers develop a territorial possessiveness about these vines, for they feed on the berries regularly. This type of behavior is not unique. I have (1958, *Wilson Bull.*, 70: 347–358), for example, observed a Mockingbird *(Mimus polyglottus)* that drove several species of woodpeckers away from a group of persimmon trees, where they were feeding on persimmons. Another aspect of the warblers' behavior is that they appear to be quick to take advantage of what other birds may be feeding upon. As described elsewhere (Kilham, 1953, *Wilson Bull.*, 65: 41), I observed an example of this behavior on 6 January 1953, when a Myrtle Warbler stayed close to and followed a Yellow-bellied Sapsucker *(Sphyrapicus varius)* that was feeding on hackberries. Such habits may have survival value for a warbler that may migrate late or even winter in the north.—Lawrence Kilham, *7815 Aberdeen Road, Bethesda, Maryland*.

A Note on the Pectoral Muscles of Birds.—It is well known that the fundamental force of wing movements is produced by pectoral muscles. The *M. pectoralis major*, attaching ventrally on the head of humerus, pulls the wing bones down, and *M. supracoracoideus (M. pect. minor)*, with its tendon passing through

the *Foramen triosseum* made by the clavicle, scapula, and coracoid, and attaching to the dorsal base of the humerus, acts as wing raiser. The author has already shown (*Miscell. Rep. Yamashina's Inst.*, No. 14: 50–59, 1960) in various species of birds that the *M. pect. major* always consists of main (*M. pect. major proprius* [of Kuroda]) and lateral (*M. pect. major lateralis* [of Kuroda]) parts, of which there appears to be no definite reference in literature. This lateral part is important functionally as the source of supinating force pulling the wing backward after downstroke (by *M. pect. major proprius*). Since this lateral part is essential in bird flight in producing the propelling effect to the wing, it is, I believe, found in all species of flying birds.

It had already been known that sailing birds have another layer, *M. pect. major profundus* (of Kuroda), as shown by Forbes (*Challenger Rep., Anat.*, 1882) and Gadow (Bronn's *Thierreich, Anat.*, 243, 1891), but no attention seems to have been given to it until my recent report (*Zool. Mag.* 69: 85–89, 1960). It is to be noted that this layer is developed in systematically quite different birds—some Accipitres, all Tubinares, Steganopodes—which indicates that it is the result of parallel adaptation to a particular (sailing) way of flight. It is rather an important point that this adaptational second layer was found, by careful dissection, in *Nannopterum harrisi*, a flightless cormorant of the Galapagos Islands (obtained by Japanese Galapagos Islands Expedition, 1959), although in extremely thin layer as were also the other parts. In flight, cormorants flap rather than sail, but there is the probability of sailing origin, since this layer is retained even in flightless condition. This suggests that this adaptational character (of *profundus*) has been fixed and retained genetically among Steganopodes.

I suggest that the function of this layer may be to cope with the wind force acting to the wing from below while sailing, so as to keep the wing motionless. The action of this layer therefore should be frequent, short, and strong. In the Tubinares, which need this function far more than do land soarers and which utilize changing air flows produced by sea waves in their pelagic sailing, this layer consists of white muscle fibers adapted for this purpose (George and Naik, *Auk*, 77: 224, 1960).

Recently, I examined the pectoral muscles of the Frigate Bird, *Fregata magnificens* of Galapagos Is., and found the third, or middle, separate layer, which I would name here, *M. pectoralis major medius*, since I could not find reference for this layer in literature. This layer is not found even in species with such marked ability to sail as *Diomedea* and should be peculiar to *Fregata*. The smallness of the body relative to the wing area is more remarkable in *Fregata* than in *Diomedea*, since the wings of *Fregata* are much wider and primaries much longer than in *Diomedea*. The forked tail is also very long, and the feet are extremely degenerated. As is known, it is the most aerial in habit among sea birds and in flight combines the soaring and high maneuverability (for which its forked tail is adapted) in aerial attack to rob other sea birds of food. Therefore, it seems to me a natural conclusion, though direct proof is lacking, that the third layer has developed for such need of flight technic with very large wing areas relative to body size. In short, the splitting of *pectoralis major* would have occurred first as an adaptation to soaring and sailing flight, but in *Fregata* this further layer presumably has been added in correlation with its maneuverability in flight.

The *pectoralis minor (M. supracoracoideus)* also splits into three portions in *Fregata* and *Sula* and some other large-winged, large birds, such as flamingos

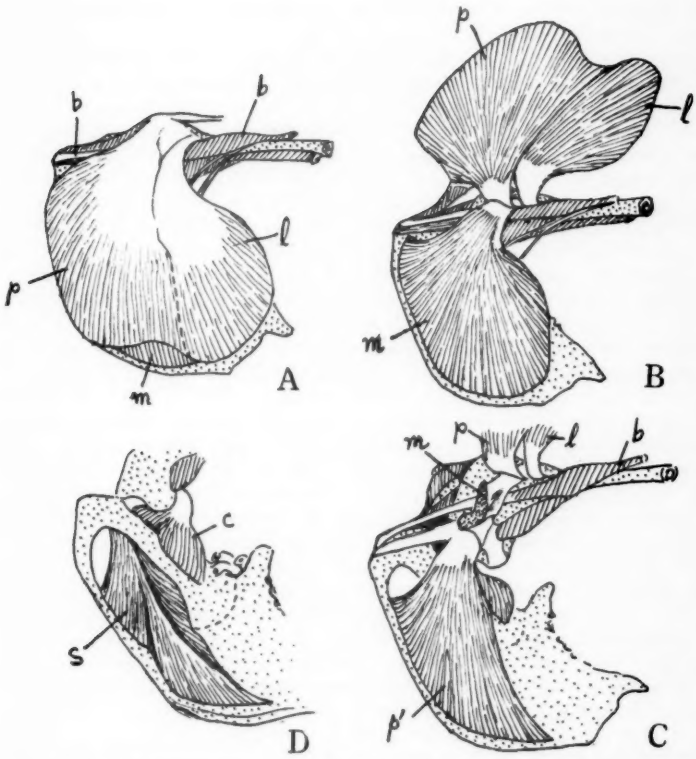


Figure 1. Pectoral muscles of Frigate Bird *(Fregata magnificens)*. Left side view: (A) external layer, showing *proprius* and *lateralis*; (B) showing the second layer, *medius*, by turning the external layer inside out; (C) the deepest third layer *profundus*; (D) *M. supracoracoideus* consisting of three parts.

b: *biceps*, c: *coraco-brachialis longus*, l: *pectoralis major lateralis*, m: *pect. major medius*, p: *pect. major proprius*, p': *pect. major profundus*, s: *supracoracoideus*.

(though single in the crane), and even into four portions in *Diomedea* (Forbes, *l.c.*; Kuroda, *Zool. Mag. l.c.*). Each part should have peculiar significance functionally, but this is not clear as yet to the writer.—Nagahisa Kuroda, *Yamashina Museum of Birds, 49 Nanpeidai, Shibuya, Tokyo, Japan.*

Wintering Tennessee Warblers.—The A.O.U. *Check-list* (Fifth Edition, p. 482, 1957) defines the winter range of the Tennessee Warbler *(Vermivora peregrina)* as from Guerrero, Oaxaca, and Guatemala south to Colombia and northern Venezuela, but does not mention any United States winter records.

On 30 January 1955 a Tennessee Warbler was picked up dead at Ossining, Westchester County, New York, by Mrs. B. D. Wood beneath her feeding station. She sent the specimen to the American Museum of Natural History, where it is now AMNH (No. 788901). The specimen was only recently identified as this species. Mrs. Wood first saw the bird alive on 12 January 1955, feeding on scraps of suet, which had been placed on the ground. She did not see it between that date and 30 January, when the bird was found dead, apparently in fresh condition. This is the first winter record of this species in New York state and apparently the second winter specimen north of Mexico. The other record is of one captured alive at Nashville, Tennessee, on 28 January 1950; the specimen is in the collection of A. F. Ganier (Laskey, *Migrant*, 21: 29, 1950). There are three sight reports of birds in winter within the United States, two from Tennessee, 17 November 1934 to 2 January 1935 and 3 January 1936, and one from Texas, winter of 1934–1935, listed in Bent (*U.S. Natl. Mus. Bull.*, 203: 87, 1953). Dr. Frederick C. Lincoln kindly furnished me with the published references to these reports, but in all instances the sight observations were without details.

To be certain that the New York specimen was not an Orange-crowned Warbler *(Vermivora celata)*, which occasionally winters in this latitude, and resembles the Tennessee Warbler in certain plumages, a careful examination was made. This specimen, an adult not sexed, is brighter green on the back than any individuals of *celata* and has the under tail coverts white, not yellowish as in *celata*. Moreover, measurements were as follows: wing (flat), 67 mm., tail, 42 mm., both of which fall within the range of *peregrina*. Mr. Eugene Eisenmann of this museum and Dr. Kenneth C. Parkes of the Carnegie Museum, who was visiting here at the time, concurred in the identification. It is of interest to note that the relatively long-winged Tennessee Warbler migrates as far as South America, while the relatively short-winged Orange-crowned Warbler is unreported south of Guatemala, with many individuals wintering in the southern United States. Thanks are due Dr. Dean Amadon for permission to publish this record.—John L. Bull, *American Museum of Natural History, New York 24, New York.*

Hudsonian Godwit *(Limosa haemastica)* in Puerto Rico.—On 9 October 1960, during the course of one of the regular Columbus Day censuses conducted by the ornithologists resident in Puerto Rico, Dr. Kenneth Burden, of Mayagüez, identified a single Hudsonian Godwit *(Limosa haemastica)* at Cartagena Lagoon, in the Municipality of Lajas, southwestern Puerto Rico.

He then led the entire group of about 25 persons to the site, where we were able to study the Godwit at a distance of about 30 meters with a 25x telescope. Then several members of the group approached cautiously and were able to study the bird from six to eight meters. The bird was not collected, but it was carefully studied at close range by the following persons, all experienced in field identification of birds in Puerto Rico: Dr. Virgilio Biaggi, Dr. Kenneth Burden, Dr. Catesby Jones, Dr. James B. McCandless, and Dr. Frank Wadsworth. This appears to be the first observation of a Hudsonian Godwit in Puerto Rico.—Nathan F. Leopold, Jr., *Brethren Service Project, Castañer, Puerto Rico.*

Caspian Terns in Jamaica.—On 28 October 1960 a plane taking off in rainy weather from the Palisadoes International Airport, which serves Kingston, Jamaica, struck a group of about 16 birds, three of which were Caspian Terns *(Hydroprogne caspia)*; the rest were Royal Terns *(Thalasseus maximus)*. So

far as I am aware, these are the first Caspian Terns to be authentically reported in Jamaica. All of the birds of both species were killed. The head of a Caspian and a full skin of another specimen of the same species have been preserved in the museum of the Institute of Jamaica. One of the Caspian Terns carried a band (Fish and Wildlife Service, No. 555–24390), which has subsequently revealed that the bird was banded on 21 June 1959 at Tobermory, Ontario, Canada. While Caspian Terns are generally common along the Central American coasts during the winter months, they appear rarely to venture among the Caribbean Islands.—C. Bernard Lewis, *The Institute of Jamaica, Kingston, Jamaica.*

First Record of the Least Frigate-bird *(Fregata ariel)* in North America.—On 3 July 1950 Bertram Leadbeater of Beverly, Massachusetts, was photographing a Bald Eagle *(Haliaetus leucocephalus)* on the rocks at Deer Isle, Hancock County, Maine, when a large bird soared overhead. Swinging his movie camera up, he was lucky enough to get some six feet of 16 mm. film of the bird. His companions, Henry S. Lewis and John E. Walsh, watched the bird for several minutes as it glided nearby, and recognized it as a Frigate-bird.

Mr. Leadbeater kindly showed me the film in August. Noting a marked white patch on the side under the wing, I turned to the cut of *Fregata ariel* in Murphy's *Oceanic Birds of South America.* We ran through the film again and noted that, as one of the observers said, the white patch looked like "a playing card placed on the body slightly on a slant." After looking at skins at the Museum of Comparative Zoology, Harvard, it was obvious that only the adult male of *F. ariel* matched the pictures. The film was then sent to Dr. Alexander Wetmore.

Dr. Wetmore writes that he examined it under a magnifier that allowed study of single frames, and through the courtesy of the laboratory of the National Geographic Society, obtained blow ups of four of the clearest frames. "These show the light spot clearly and indicate without question that the species photographed was *Fregata ariel* (G. R. Gray). This species ranges in the Pacific from the Philippines and coast of China to Australia; in the western Indian Ocean; and to South Trinidad Island in the Atlantic [700 miles east of Victoria, Brazil]. . . . The supposition would be that the bird seen in Maine was from the South Trinidad colony, although there is no absolute certainty regarding this. At any rate, it is a species that has not been found earlier in our North American region."

All authorities agree as to the essentially sedentary nature of frigate-birds, which are rarely seen out of sight of land. It is amazing that *Fregata ariel,* seldom observed in the Atlantic, and little known away from its island homes of South Trinidad and Martin Vas, not only visited our coast, but was photographed. Negatives and prints are on file at the Peabody Museum of Salem (PMS–k 17).—Dorothy E. Snyder, *Peabody Museum, Salem, Massachusetts.*

An Example of the Whisper Song of the Gray Jay *(Perisoreus canadensis).*—On 12 September 1960 Mrs. O. E. Devitt, Miss Margaret McKay, and I stopped for lunch beside the Oxtongue River in Algonquin Provincial Park, Ontario; four Gray Jays appeared and, as is their habit, began looking for handouts. After receiving small pieces of bread, they remained in nearby trees watching us. One individual, which was perched on the lower branch of a spruce within three meters of us, began to sing a whisper song. The movement of the throat muscles could be clearly seen as the bird sang. The warbling song was subdued but easily audible to all of us. It was quite varied, somewhat resembling that of the Purple

Finch *(Carpodacus purpureus)* but with an occasional harsh jaylike note. A certain ventriloquistic quality made it seem to be coming from trees farther off. The song lasted about 25 to 30 seconds. References in the literature to this type of song are rare indeed. Probably the closest description to the one we heard is that given by Warren (*Auk*, 16: 14, 1899). Lawrence (*Auk*, 74: 269, 1957; *Audubon Mag.*, 62: 287, 1960) described a similar song, which she called "displacement singing," uttered in moments of frustration when there arises "a conflict between two drives which possessed the jay, the urge to feed and the urge to flee, caused by hunger and the finding of food in an unapproachable place." The latter situation was probably the case with our bird. However, Lawrence's assumption that there is a correlation between this song and the breeding season can hardly be applicable in the present instance.—O. E. DEVITT, *83 Harding Blvd., Richmond Hill, Ontario.*

The Effect of Parasitism by the Brown-headed Cowbird on Empidonax Flycatchers in Michigan.—In Michigan three of the four *Empidonax* flycatchers are periodically parasitized by the Brown-headed Cowbird *(Molothrus ater ater)*. The incubation period of the Cowbird eggs in two Field Sparrow *(Spizella pusilla)* nests that I followed in June 1945 was 12, possibly 13, days. Following is a summary of my observations of many nests of the four *Empidonax* flycatchers in Michigan.

YELLOW-BELLIED FLYCATCHER *(E. flaviventris)*. I have observed six nests of this species of which none were parasitized by Cowbirds. Due to the type of habitat used, usually spruce-sphagnum bogs or alder-grown areas, the species is seldom parasitized. The incubation period at one nest in Schoolcraft County in June-July 1956 was 15 days.

ACADIAN FLYCATCHER *(E. virescens)*. In 67 nests, the contents of which were known, 16 (24 per cent) were parasitized by Cowbirds. Table 1 shows in more detail this parasitism.

All nests had only one egg, except for one that had three Cowbird eggs. Three nests containing three host and three Cowbird eggs were deserted. Two Cowbird eggs disappeared from nests, one of which could have fallen through the bottom of the nest; the other could probably have been removed by the host. Two eggs were built into the bottom of the nests in which they were found. Thus seven eggs had no chance of survival. Of the remaining 11 eggs six hatched, and all six fledged, one from each of six nests. In all six cases no Acadian Flycatcher young fledged. In all but possibly one case no flycatcher eggs even hatched.

In six nests in which the incubation period (the period between the laying and hatching of the last egg) of the Acadian Flycatcher was known in Calhoun County, two were 13 days; three, 14 days; one, 15 days. In one nest in Oceana County this period was 14 days. Nestling periods of the Acadian Flycatcher in Calhoun County have been: one, 12 days; one, 13 days; five, 14 days. In Muskegon County, one was 13 days.

When the young Cowbird hatched, always prior to the hatching of the host eggs, the Acadian Flycatcher abandoned continuous incubation, and its eggs failed to hatch. In most cases its eggs remained in the nest even when the young Cowbird fledged.

In all parasitized nests the Cowbird eggs were laid in June. Among banded birds I have found several instances of the Acadian Flycatcher raising two broods

during one season. The eggs of the second brood are usually laid in mid-July, and in no case have I found a second set that contained a Cowbird egg.

TRAILL'S FLYCATCHER *(E. traillii traillii)*. In 53 nests that I have observed, only four (7.5 per cent) have been parasitized by Cowbirds.

One Cowbird egg was laid in each of these four nests. One was destroyed; a second was built in the bottom of the nest and deserted; two each produced only one young Cowbird, and in one nest, three of the host eggs remained in the nest even after the young Cowbird left the nest. None of them hatched.

Since the Traill's Flycatcher nests along marsh borders in small shrubs, it is much less susceptible to parasitism by Cowbirds than is the Acadian Flycatcher.

LEAST FLYCATCHER *(E. minimus)*. Although many nests of the Least Flycatcher were found, the contents of many nests were not known. I found only two (9 per cent) of 22 nests parasitized by the Cowbird. One was immediately deserted; the other produced only a young Cowbird. These nests were in cutover woodland, and most of them were in Muskegon, Oceana, Schoolcraft, and Alger counties. At one nest in Charlevoix County the incubation period of the Least Flycatcher was 13 days. At a nest in Muskegon County the nest was destroyed 12 days after the laying of the last egg, and the eggs still had live embryos when I

TABLE 1

SUCCESS OF ACADIAN FLYCATCHER EGGS AND NESTS

County in Michigan	*Nests*	*Nests in which eggs hatched*	*Nests in which young left*	*Eggs laid*	*Eggs hatched*	*Per cent*	*Young fledged*	*Per cent*
				Unparasitized				
Calhoun	21	15	14	57	36	63.14	33	57.89
Muskegon	24	22	18	67	50	74.63	44	65.67
Others[1]	5	4	3	14	9		7	
Total	50	41	35	138	95	68.84	84	60.87
				Parasitized				
Calhoun	9	1	1	15	2	13.33	2	13.33
				11[3]	5[3]	45.45	5[3]	45.45
Muskegon	5	3	3	13	4	30.77	4	30.77
				5[3]	1[3]	20.00	1[3]	20.00
Others[2]	2	0	0	2	0		0	
				2[3]	0		0	
Total	16	4	4	30	6	20.00	6	20.00
				18[3]	6[3]	33.33	6[3]	33.33
Complete Total	66	45	39	168	101	60.12	90	53.57

[1] Allegan, Barry, Jackson, and Oceana counties.
[2] Branch and Kalamazoo counties.
[3] Cowbird egg or young.

The Barry, Calhoun, Jackson, and Kalamazoo county areas were woods, unpastured but surrounded by tilled farmland. The Muskegon, Oceana, and Allegan areas were natural, unpastured, wilderness areas. The Branch County area was along a river in a village.

TABLE 2

SURVIVAL OF NESTS AND EGGS OF THE EMPIDONAX FLYCATCHERS IN MICHIGAN

Species	Nests	Nests in which eggs hatched	Nests in which young fledged	Per cent	Eggs laid	Eggs hatched	Per cent	Young fledged	Per cent
E. flaviventris	4	4	—		16	15	(100)	—	—
E. virescens	66	45	39[2]	(59.1)	163	101	(60.1)	90	(53.6)
E. traillii	43	23	23[3]	(53.5)	139	80	(57.5)	76	(53.9)
E. minimus	16	10	9[4]	(56.2)	56	42	(75.0)	34	(60.7)
Total[1]	125	78	71	(56.8)	363	223	(61.4)	200	(55.1)

[1] *E. flaviventris* not in totals (the 100 per cent hatch was because the 16th egg was collected).
[2] Six nests of *E. virescens* produced no young Acadian Flycatchers, but each produced one young Cowbird.
[3] Two nests of *E. traillii* produced no host young but each one Cowbird.
[4] One nest of *E. minimus* produced no host young but one Cowbird.

examined them where they lay on the ground beneath the nest site and would have hatched in about a day. All nests of the Least Flycatcher were built in tall, spindly trees except two built out on horizontal branches high above the ground.

SUMMARY

In Michigan three of the four *Empidonax* flycatchers have been found parasitized by the Brown-headed Cowbird *(Molothrus ater)*. The fourth, *E. flaviventris*, nests on the ground in bogs or damp, alder-grown areas in the northern part of the state so at present is not susceptible. Only six nests of this species have been found in Michigan, and all were without Cowbird eggs.

The Acadian Flycatcher *(E. virescens)*, which nests in dense, unpastured woodlands primarily in beech and hemlock in southern and western Michigan and only in the southern part of the state, is the most susceptible to parasitism by Cowbirds. In 67 nests, 16 (24 per cent) were parasitized. Traill's Flycatcher *(E. traillii)* is less susceptible. Only four of 53 nests (7.5 per cent) were parasitized. Only two of the 22 nests examined of the Least Flycatcher *(E. minimus)* were parasitized. Of these 22 parasitized nests nine produced one Cowbird each. Yet in all nine nests not one flycatcher was fledged, and in all but possibly one nest the host eggs did not even hatch.

The Brown-headed Cowbird with a shorter incubation period hatched in all cases prior to the hatching of the flycatcher eggs. Apparently, the female flycatcher abandons steady incubation by the next day, and the flycatcher eggs then fail to hatch. The flycatcher incubation periods have ranged from 13 to 15 days, while the Cowbird incubation period was 12–13 days.

In three cases the Cowbird egg was built right into the bottom of the nest (*E. virescens*, 2; *E. traillii*, 1). Five nests were deserted (all three species), and in one nest of *virescens* an egg disappeared, indicating that it was pushed out by the flycatcher.—LAWRENCE H. WALKINSHAW, *819 North Ave., Battle Creek, Michigan.*

Weights and Measurements of Organs of Bonin Island Petrels, *Pterodroma leucoptera hypoleuca*.—In December 1959 an opportunity to collect avian material on Midway Atoll was made possible by grants from the American Philosophical Society, the Bureau of Aeronautics, and Southern Illinois University, and by the cooperation of the United States Navy. Dr. John C. Downey of Southern Illinois University aided in the collection.

The petrels were picked up on the ground or taken in nets in an area where, as a result of construction activities, they would have been killed in their burrows. The birds were quickly killed by tracheal injection of ethyl chloride. Measurements of body weight, wing length, heart weight, and liver weight were made immediately. The heart was slit open and all blood removed before weighing; blood vessels were cut off as near as possible to the heart. Liver weight was measured after the gall bladder had been removed and the liver blotted on paper to remove surface moisture. Wing area was obtained by cutting paper silhouettes and weighing them; various tests and comparisons with areas measured with planimeters indicated less than 5 per cent error. Samples of endo- and ectoparasites and of blood were saved before the skeleton was prepared; these materials are presently being studied.

No significant sexual difference was found in wing length (34 males and 36 females; both means were 76±0.3 mm.), in wing area (524±6.3 and 526±4.7 mm., respectively), in wing area per gram of body weight (2.8±0.05 and 2.9±0.04, respectively), in heart weight (40 males and 39 females, 2.1 grams), or in the ratio of heart weight to body weight (1.2 per cent). Body weight is statistically the same in the two sexes, but males consistently average somewhat heavier.

The most interesting information on weights came from samples taken at different times of the day (Table 1). In discussing these the midpoint of the time period will be used; that is, the period from 2:00 to 6:00 P.M. will be stated as

TABLE 1

DIURNAL CHANGES IN LIVER AND BODY WEIGHT IN BONIN ISLAND PETRELS

		Liver weight, grams		*Liver as per cent of body weight*		*Body weight, grams*	
	N	*Mean**	*Range*	*Mean**	*Range*	*Mean**	*Range*
Males							
2–6 p.m.	10	4.9±0.24	3.5–6.1	2.8±0.10	2.3–3.4	175±1.0	153–185
6–10 p.m.	14	6.4±0.31	4.6–7.9	3.4±0.13	2.4–4.0	188±4.2	165–207
10 p.m.–2 a.m.	12	6.7±0.36	5.0–9.0	3.7±0.21	2.6–5.2	182±4.1	162–201
2–6 a.m.	10	6.5±0.23	5.4–7.7	3.4±0.15	2.7–3.9	195±6.1	165–230
6–10 a.m.	12	5.6±0.23	4.1–6.6	3.1±0.10	2.4–3.6	184±5.1	160–216
10 a.m.–2 p.m.	10	5.4±0.30	4.3–7.7	3.1±0.13	2.4–3.7	177±6.3	154–209
Females							
2–6 p.m.	11	4.5±0.22	3.6–5.5	2.6±0.11	2.0–3.1	170±3.6	150–185
6–10 p.m.	14	6.0±0.15	5.2–7.3	3.3±0.07	3.0–3.7	182±2.8	169–206
10 p.m.–2 a.m.	18	5.9±0.23	4.2–7.3	3.3±0.12	2.3–4.2	178±3.0	157–208
2–6 a.m.	12	6.6±0.21	5.6–7.9	3.5±0.08	3.0–3.9	188±4.2	166–212
6–10 a.m.	10	5.0±0.19	4.1–5.9	2.9±0.14	2.8–3.6	171±3.4	151–185
10 a.m.–2 p.m.	11	4.8±0.18	4.1–5.9	2.7±0.09	2.2–3.2	177±2.9	164–197

* With standard error.

4:00 P.M. Although body weight appeared to be nearly equal in the two sexes for most periods of the day, it is interesting to note in Table 1 that at 8:00 A.M. males were significantly heavier ($P = 0.05$).

In males, body weight was least between noon and 4:00 P.M. By 4:00 A.M. body weight had increased 11 per cent ($P = 0.01$) with the most significant increases occurring between 4:00 and 8:00 P.M. and between midnight and 4:00 A.M. From the high at 4:00 A.M. body weight of males decreased gradually, and without statistically significant differences between successive sampling periods, until 4:00 P.M.

In females, body weight showed much the same pattern of variation except that it reached its low at 8:00 A.M. and maintained this level without statistically significant change until 4:00 P.M. Total increase was 11 per cent ($P = 0.01$). Between 4:00 and 8:00 A.M. body weight in females dropped abruptly; the change ($P = 0.01$) in this time constituted virtually the entire 12-hour loss in body weight. In this same span of time there was also a major decrease in the weight of males, but it accounted for only half of their total loss in body weight.

Liver weight showed variations of much greater relative magnitude. In both sexes this weight was least from noon to 4:00 P.M. The greatest weight was reached between midnight and 4:00 A.M., with some indication that in the female the buildup continued somewhat longer; rather than simply maintaining the increased weight between midnight and 4:00 A.M., as in the male, there was a significant increase ($P = 0.05$) during this time in the female. This may be related to a possible sexual difference in feeding habits. Unfortunately, it was not until the analysis of data was started that a possible difference in feeding time was observed. Hence data bearing directly on this point are neither abundant nor conclusive. Females predominated in collections made early in the evening. At 10:00 P.M., in one collection made, 25 birds were taken—17 (9 males, 8 females) on the ground and 8 (1 male, 7 females) from the air. The next evening (10:00 P.M.) 41 petrels were taken—10 males and 14 females on the ground, and 4 males and 13 females from the air. At midnight, of 17 birds taken on the ground 12 were males and 5 were females; 12 males and 13 females were netted from the air. At 1:30 A.M. twice as many birds were collected on the ground (31 males and 34 females) as in the air (12 males and 13 females), but the sex ratio was the same in both instances. These data may indicate that, in December at least, most females emerge and begin to feed earlier and thus feed for a longer time.

In absolute values the liver weight fluctuated 37 per cent ($P = 0.01$) in males and 47 per cent ($P = 0.01$) in females during the 24 hours. Relative to body weight (Table 1), the fluctuations in liver weight were 32 and 35 per cent, respectively. In both sexes the major increase was between 4:00 and 8:00 P.M.; the period of most rapid decrease was between 4:00 and 8:00 A.M.

Fisher and Bartlett (Diurnal Cycles in Liver Weights in Birds, *Condor*, 59 (6): 364–372, 1957) first found a liver cycle in Red-winged Blackbirds *(Phoeniceus agelaius)* and Starlings *(Sturnus vulgaris)*. In the wintering birds of their study, the males showed a greater overnight loss in liver weight (Red-wings: 32 per cent in males, 22 per cent in females, and Starlings: 40 per cent in males, 25 per cent in females). Fisher (MS) has since noted a cycle of comparable magnitude in Cowbirds, Rusty Blackbirds, Common Grackles, and domestic chickens. All these species are diurnal and granivorous and/or insectivorous.

One significance of the present note then lies in making known a daily cycle in

liver weights in the Bonin Island Petrel, which is nocturnal and marine, and which subsists largely on squids. In this petrel the cycle of liver weights follows the pattern of change of the body weights, but percentagewise the liver variations are three times as great. The greater fluctuation in liver weight in the female petrels, as contrasted with greater fluctuation in the male of other species, may be related to the prebreeding condition of the petrels and the wintering status of the Redwings and Starlings.—HARVEY I. FISHER, *Department of Zoology, Southern Illinois University, Carbondale, Illinois.*

Virginia Rail (*Rallus limicola limicola* Vieillot) Breeding at Vermilion, Alberta.—On 6 July 1958 an adult male Virginia Rail was collected from a partially flooded *Carex* meadow in Grizzly Bear Coulee, five miles south and three miles east of the town of Vermilion, Alberta. The specimen was deposited in the National Museum of Canada (Catalogue Number 41559), on behalf of the Canadian Wildlife Service, by which the author was temporarily employed to assist in waterfowl studies.

At the time the bird was collected, there was one other adult present. Both birds were exhibiting a distraction behavior as though there was a nest or a brood present. Three days later, an adult was seen feeding two downy young approximately three feet from the site where the specimen had been collected. At this time, two more adult Virginia Rails were observed. One was seen one-half mile west, and the other, one mile west of the collection site. These birds also exhibited distraction behavior.

The A.O.U. *Check-list of North American Birds* (1957, Fifth Edition) defines the northern limit of the breeding range of the Virginia Rail in Alberta as Brooks, 200 miles south of Vermilion. Prior to the collection of the specimen reported herein, the only other specimen collected north of Brooks was an adult male taken near Fort Chipewyan by T. M. Shortt on 30 June 1945 (Specimen Number 72295, Royal Ontario Museum). Although the Virginia Rail has been recorded from this more northerly point, the author believes that the collection of the adult Virginia Rail at Vermilion and the subsequent observation of an adult feeding two downy young at the same site would serve to constitute a new northern record for the breeding range of this species in Alberta.—JAMES K. LOWTHER, *Department of Zoology, University of Toronto, Toronto 5, Ontario, Canada.*

Plumage Peculiarity in Cedar Waxwing.—A specimen of Cedar Waxwing *(Bombycilla cedrorum)* was collected from a flock of 18 to 20 birds at Stoneham, 40 kilometers (25 miles) north of Quebec City, on 7 July 1957. Examination of the specimen showed a peculiar coloration of the terminal appendages of the secondaries, the usual bright red being replaced by a bright yellow.

The bird was an adult female whose ovary was well developed. The color of other external parts did not prove different upon comparison with a series of females in the Quebec Provincial Museum. The mean lengths of the wing and culmen of 10 females were: wing 92.6 mm. and culmen 9.5 mm., while for the abnormally colored specimen these measurements were 93.6 mm. and 9.5 mm., respectively. The specimen is preserved in the author's collection as Number 147. —HENRI OUELLET, *341 Fourth St., Quebec City, P.Q. Canada, or The University of New Brunswick, Fredericton, N.B., Canada.*

Behavior of a California Gull Devouring a Juvenile Coot.—On 3 June 1960, while driving along the west side of Unit 2 of the Bear River Migratory Bird

Refuge located west of Brigham City, Utah, I observed a California gull *(Larus californicus* Lawrence) flying low over open water as it dropped a dark, limp object from its mouth. The object proved to be a dead juvenile coot (*Fulica americana americana* Gmelin) about two weeks of age. The gull alighted on the water immediately and placed the carcass at a right angle and to the right of itself. The head of the coot was grasped and squeezed in an apparent effort to crush the skull, as the carcass was lifted off the water. The gull worked the coot through its bill by a series of head and neck movements somewhat like throwing and catching an object at different points progressively down its length. Thus the coot was mouthed from head to foot before it was dropped to the water again. The gull then methodically attacked the carcass with the tip of its bill. Powerful, short jabs were made at various parts of the body to soften it even more. This mouthing and stabbing procedure was repeated several times in the same manner until three other California gulls appeared. These intruders made swooping passes at the dead coot, which caused the feeding gull quickly to grab its meal and attempt an escape. The carcass was gripped by the neck in the tip of the gull's bill, which caused the burden to be unbalanced and too cumbersome to carry. As the coot was dropped from a height of about 10 meters, there immediately occurred a series of midair acrobatics amidst a squawking of fighting gulls. Within less than half a minute the three intruders were beaten off without a single attempt to dive down and take the carcass.

The original owner alighted beside the coot again and, without further hesitation, lined the carcass up in front of itself, head first, and began to swallow it. When the coot's head disappeared down the gull's throat, the mandible of the gull was in a position directly underneath the carcass so that the coot could be lifted off the water and held aloft. The weight of the coot, thus arranged, allowed it to be swallowed easily and quickly as the gull held it over its head. When just the feet protruded from the mouth, the gull took flight. Just after the feet of the coot disappeared down the throat of the airborne gull, two more gulls appeared on the scene. They made a pass, but the meal was safely hidden and stowed away for digestion as the feeding gull continued on its way.—Nicholas J. Chura, *Wildlife Research Unit, Utah State University, Logan, Utah.*

Woodcock Nesting in Brazos County, Texas.—On several occasions in the past 20 years I have seen, or had reported to me, wintering woodcock *(Philohela minor)* in Brazos County, Texas, but not until 1959 was I able to determine with certainty that woodcocks also nest in this area.

On 27 February 1959 students who were mapping vegetation on a section of the Range Management Pasture about two miles west of College Station reported a woodcock nest with four eggs. On 28 February I confirmed the identification, and Professor Jack Inglis took several photographs of the incubating female and of the nest and eggs. The nest consisted of a few dead oak leaves placed in a slight depression on a knoll in a moderate stand of post oak trees. The understory was mainly yaupon. The set of eggs was collected and is now deposited in the Texas Cooperative Wildlife Collection. I estimated on the basis of embryo development that the eggs had been incubated about 10 days.

A second nest containing three eggs was found by Knox Walker on 20 March 1959, in a section of the archery range (within half a mile of nest No. 1) that had been burned over about three weeks previously. A third nest with four eggs was

found on 14 February 1959 by Dale Avant in the Middle Pasture of the Range Management Area (same general area as nest No. 1). He revisited the site on 25 February and found the incubating bird on the nest. Students also reported nesting woodcocks in the same general area this past spring (1960), but I was unable to get specific data.

Inquiry among field biologists of the Texas Game and Fish Commission and the U.S. Fish and Wildlife Service in east Texas failed to produce any authenticated nesting records of woodcock in that region, although the birds winter there regularly. The only other positive record I have found of woodcock nesting in Texas is that of Pettingill (*Mem. Boston Soc. Nat. Hist.*, 9, 1936) for Hardin County in 1905. I have been unable to locate the basis for the statement by the A.O.U. Committee (Fifth Edition of the *Check-list*) that woodcocks formerly nested in Houston County. The Committee's statement that these birds presently nest in "extreme eastern Texas (rarely)" seems to be based on the probability (not on actual records) that woodcocks observed in that area in summer nested there. It seems reasonable to conclude that woodcocks nest in eastern Texas only in years, like 1959 and 1960, when winter rains are considerably above normal.—WILLIAM B. DAVIS, *Department of Wildlife Management, Texas A. and M. College, College Station, Texas.*

Recovery of a Crippled Gadwall.—A Gadwall *(Anas strepera)* was shot on the J. M. Skrabanek farm located at Danberry, Brazoria County, Texas, on 9

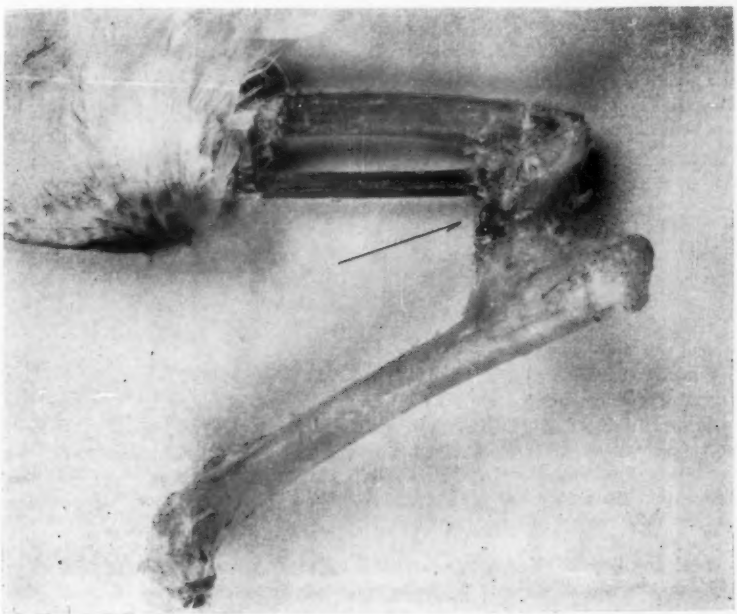


Figure 1. Ventral view. Arrow points to shot that broke the wing.

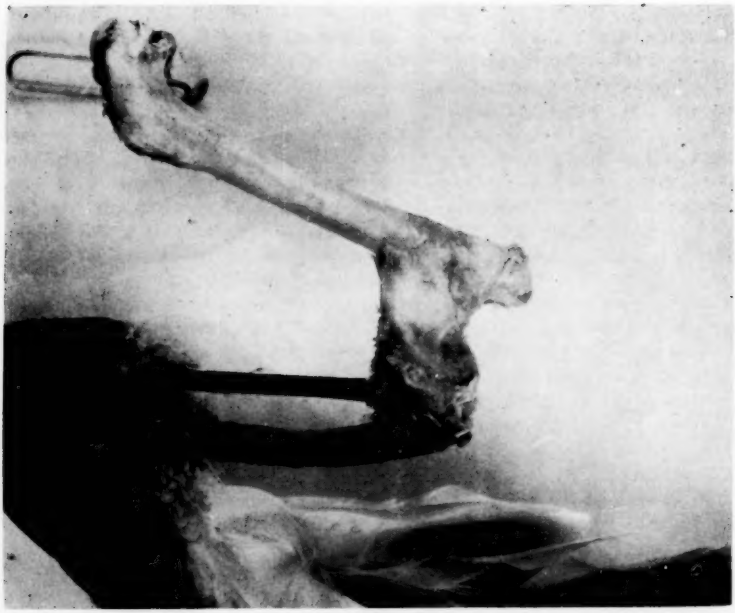


Figure 2. Dorsal view. Shows the bridge of bone. The wing was broken 5/8" from the joint. Bone bridge goes from place of the break to the side of the humerus.

November 1958, as it flew over a spread of decoys. It was, apparently, capable of normal, or nearly normal, flight even though the humerus was shortened and distorted from its ordinary position. Nothing unusual in the flight of the bird was noted at the time it was shot. The irregularity of the humerus was noted while dressing the bird. The shot that broke the wing can be seen embedded in the bone. The severity of the break and the large bridge of bone indicate that the bird may have been wounded several months previously. The recovery from such a severe wound is remarkable.

Chapman (1937, *Bird-lore*, 60: 268–269) reports a hunting-season injury to the humerus of a merganser. He stated that the mending of the fracture had left the bone greatly distorted and useless in flight. Tiemeier (1941, *Auk*, 58: 350–359), in his survey of the repaired bone injuries in birds, found 11 injuries of the humerus. Since this was a skeletal study, he was not able to show anything except that the injury had been repaired.—Olan W. Dillon, Jr., *Biologist, Soil Conservation Service, Ithaca, New York.*

Late Feeding of Young Lapland Longspur in New York.—On 9 October 1960, on the sand spit south of the inlet at Sandy Pond, Oswego County, New York, at the eastern end of Lake Ontario, two Lapland Longspurs *(Calcarius lapponicus)* landed close to the water in some drift and scrubby grasses. Four of

us approached them slowly, until we were too close to use binoculars. One of the birds was adult, the other a bird of the year. As we watched, the young bird begged repeatedly, and the adult was seen to feed it at least twice, although the nature of the food could not be seen. In a species that nests as far north as does the Lapland Longspur it is certainly unusual for an adult to be still feeding a youngster at this late date, at this latitude. It is also unusual that this feeding activity was occurring in birds that had already molted into winter plumage.—SALLY F. HOYT, *Laboratory of Ornithology, Cornell University, Ithaca, New York.*

A Second Egg Tooth in a Mourning Dove?—A Mourning Dove *Zenaidura macroura*, hatched 6 June 1960, possessed a protuberance on the lower bill in a position and in color equivalent to the egg tooth on the upper bill. The size of the abnormal growth is perhaps twice that of the egg tooth. It also may be noted that the lower bill is slightly longer than normal in relation to the upper bill.

The photograph was taken after death at two days of age. The squab was being fed artificially, and its death was not necessarily related to the abnormality.

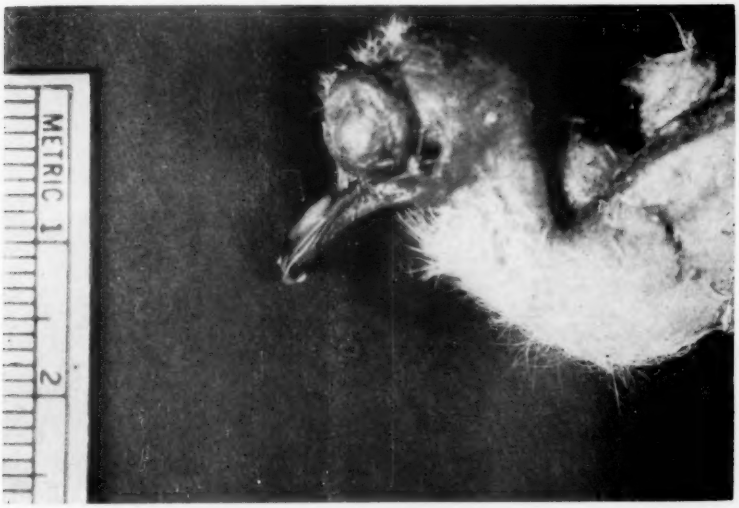


Figure 1. Abnormal growth resembling egg tooth on lower bill of a young Mourning Dove.

A "cold shock" was possible midway through incubation when both parents were frightened by children and left the nest for several hours. The parents were not siblings, otherwise their relationship is unknown.—WILMER J. MILLER, *Department of Microbiology, Serology Laboratory, School of Veterinary Medicine, University of California, Davis, California.*

An Old New York Record for the White Pelican.—On Thursday, 11 December 1788 *The New York Journal and Weekly Register* (p. 2) carried the following item: "A few days ago, a curious and uncommon BIRD was killed at Saratoga and sent, as a rarity, to Albany. The distance from the tip of one wing to the

other when both were extended, was nine feet and two inches; the mouth was large enough to contain, with ease, the head of a boy of ten years of age, and the throat so capacious as to admit the foot or leg of a man boot and all. Doubts were entertained, at first, what it was, but it is now decided to be the large Pelican of the sea coast, as upon examination we are told (by Dr. Mitchell)[1] that it agrees to the character of the *Pelicanus Acquillus* [*aquilus*] *of Linnaeus* [White Pelican] and the *Onocratalus* of Brisson."—CONSTANCE D. SHERMAN, *American Museum of Natural History, New York City.*

Nests of *Empidonomus varius*, *Pitangus lictor*, and *Myiozetetes cayanensis*.—The nest ascribed by Haverschmidt (*Auk*, 74: 240, 1957) to *Pitangus lictor* was undoubtedly that of *Empidonomus varius*. The Penard brothers' (*De Vogels van Guyana*, Vol. 2, 263, 1910) description of the nest of *E. varius* corresponds closely with the one described by Haverschmidt. Their statement that *P. lictor* builds an open nest (*op. cit*, 246) is incorrect: also the size given for the eggs is small for that species. I am indebted to G. D. Smooker *(in litt.)* for information regarding eggs in the Penard Collection in the Leyden Museum: he states that the eggs attributed to *P. lictor* are certainly not of that species, and on the authority of R. Kreuger that there are no eggs of *Empidonomus varius* in the collection. Beebe (*Tropical Wild Life in British Guiana*, 225, 1917) gives a good first-hand description of the nest of *E. varius*. Haverschmidt's statement that Young's note on *P. lictor* (Ibis, 1929, 227) refers to *Myiozetetes cayanensis* is partly correct, but in my opinion the nests and eggs described are those of *P. lictor*, while the descriptions of voice and display apply unmistakably to *M. cayanensis*. That Young confused the two species is also suggested by his omission of *M. cayanensis*, the commoner bird, from his list. In the notes that follow the information given me by Sir Charles F. Belcher, J. D. Macdonald, and G. D. Smooker is gratefully acknowledged.

Empidonomus varius is considerably smaller than *P. lictor*, and is very distinct in spite of broad similarities in plumage, especially the head pattern. It utters a rather harsh *chee-chee-chu*, the final syllable prolonged. I found a nest in a low tree overhanging the Boerasiri canal near the British Guiana coast in June 1927, and later at H.M.P.S., Mazaruni, saw four more occupied nests on outer branches of Citrus bushes. I was with Sir Charles Belcher when he took the clutch of two eggs (Belcher Collection, British Museum [Natural History]) from one of these on 28 January 1932. The eggs are regular ovals, pale buff with warm-brown spots and blotches, and pale, slate-gray shell marks, well distributed but tending to be concentrated at the large end. Macdonald *(in litt.)* found both eggs of Belcher's set to measure 21 × 15.5 mm., and a clutch from Brazil (Crowley Bequest) 20.8 × 15.8, 21 × 16 mm.; he noted that the latter are slightly more heavily marked. The nests I examined were frail, shallow saucers of dead weed stems, coarse in the foundation, of finer material and smooth inside, and sometimes lined with fine rootlets, rather like doves' nests. They were on horizontal forks near the ends of branches.

G. D. Smooker, who knew *Pitangus lictor* well on the British Guiana coast, found it a rather silent bird, and he heard it utter only a rather plaintive *quirk* without assuming the display postures characteristic of *P. sulphuratus* when mak-

[1] Samuel Latham Mitchell, 1764–1831, studied medicine and law. He was a member of the legislature for several terms, was appointed Professor of Chemistry, Natural History and Philosophy in Columbia College in 1792, and made the first voyage in a steamboat with Fulton in August 1807.

ing its loud *kiskadee-kiskadee* cry, and it was much less common. I found the domed nest of *P. lictor* on a lower, horizontal branch of a mango tree at H.M.P.S., Mazaruni, on 23 October 1936. The three eggs, now in the Belcher Collection of the British Museum (Natural History), are regular ovals, pale cream with deep-lilac and purplish-slate shell marks and warm-brown and blackish blotches and spots, chiefly at the large end: they measure 27 × 20.5, 25.7 × 20.3, 25 × 20 mm. Macdonald *(in litt.)* has compared them with eggs of *P. sulphuratus* (Belcher Collection) from Trinidad, and with two eggs said to be *P. lictor* (Crowley Bequest) from Brazil: he finds them more like the latter, and smaller than those of *P. sulphuratus*. Another clutch (Belcher Collection) was taken by Belcher from a domed nest near Georgetown, British Guiana, in February 1936. He thought at the time they were a clutch of small *P. sulphuratus*, but Smooker recognized them as *P. lictor*. I have seen them recently, and have their measurements, 27.5 × 19.5, 26.5 × 19, 25.7 × 19.1 mm., from Macdonald. They differ from my set in being more elongate and marked only with well-distributed, small, black spots. In February 1938 I saw several nests of *P. lictor* on the lower Berbice River, British Guiana, on low branches of thorny bushes (*Drepanocarpus* sp.) overhanging the water.

The other species, *Myiozetetes cayanensis*, that has been confused with *P. lictor*, is about the same size as *E. varius*, and builds a domed nest. It utters a short trill when displaying, and at other times a plaintive, drawn-out whistle. During display, common to both sexes, it sits rather upright and opens and quivers the wings with crest raised, the postures being very like those of *P. sulphuratus*. In the period 1932–1939, I examined about 30 occupied nests of *Myiozetetes cayanensis* at H.M.P.S., Mazaruni. They were built in trees or bushes at heights from one to 11 meters above the ground, most commonly between two and four meters. They were made of grass, sometimes mixed with teased-out fibers and fine, pliable stems, and were finished smoothly with fine material inside. In one case there were a few white feathers as lining, and white decorations, *e.g.*, rags, string, feathers, and lichen, were frequently seen around, and especially below, the entrance, long material being gathered up in loops. The nests varied in size but were smaller than those of *Pitangus* spp., and proportionately less deep, inside measurements being 6–7.5 cm. in diameter and about 4 cm. deep below the 5-cm. entrance hole. Smooker *(in litt.)* observed that the nests of *Pitangus* can be lifted bodily almost intact from their position whereas those of *M. cayanensis* are built into, or even woven among, the supporting twigs. The clutch was usually two and occasionally three, the eggs being rather long and slightly pointed ovals, whitish, spotted with reddish brown, chiefly at the large end, the spots sometimes replaced by small, paler, washy blotches. One set (Belcher Collection) measured 23 × 16, 22 × 15.5 mm. This species was the principal host of the nest-usurping *Legatus leucophaius* at H.M.P.S., Mazaruni.—T. A. W. Davis, *South Mullock, Haverfordwest, Pembs., Great Britain.*

Mr. Davis states categorically that the nest with eggs of *Pitangus lictor* described by me (*Auk*, 74: 240, 1957) belongs to *Empidonomus varius* but fails to bear in mind that I flushed and shot the sitting bird, a practice I always (reluctantly) follow in such cases. I can add that on 23 February 1958 I found in the same locality another nest of *Pitangus lictor* in the same situation in a young shade tree (an open-cup nest neatly built of small roots and branches and the nest cup lined with very fine roots), which contained three nestlings with sprouting feathers while the parent birds sat scolding in the nest tree when I examined the

nest. *Empidonomus varius* is indeed a very different bird that can be confused (at least in this country) only with *Legatus leucophaius*. Moreover, it is not, as Mr. Davis states, "considerably smaller" than *P. lictor*.

The wing measurements and weights of material collected by me in Surinam are:

Pitangus lictor,
wing 5 ♂♂ 89–97 mm., 4 ♀♀ 82–96 mm.
weight 9 ♂♂ 23–28 grams, 6 ♀♀ 20–28 grams.

Empidonomus varius,
wing 6 ♂♂ 93–97 mm., 3 ♀♀ 91–95 mm.
weight 13 ♂♂ 23–27 grams, 4 ♀♀ 23–25 grams.

Furthermore, *Empidonomus varius* does not breed in the locality where I found *P. lictor* nesting. *E. varius* has (at least in the region where I live) a wholly different habitat as it nests in the sandy savannas with scattered bushes more into the interior of the country and not in the coastal plane where *P. lictor* is common.

I wholly agree with Mr. Davis that the description by Beebe of the nest of *E. varius:* "a weak flimsy platform of twigs fashioned like the nest of a dove and placed in an exposed position" is most characteristic. It agrees with my own experience. But this flimsy dovelike platform cannot be confused with the well-built nest and with a distinct and neatly lined nest cup of *P. lictor* as shown on my photograph.

Mr. Davis further quotes some second-hand evidence on material in the Penard egg collection from Surinam, which is preserved in the Leiden museum, but apparently does not know the revision by Hellebrekers (*Zool. Meded.*, 24, 1942 and 25, 1945) of this collection.

I am aware of the fact that there are a number of misidentifications in this collection, but the same holds true for some of the statements by Young and also for the Belcher and Smooker collection from Trinidad.

However, the description of the nest of *P. lictor* by the Penards in their book is correct, and the measurements of its eggs correspond with mine, so I see no reason to doubt the identity of the eggs of *P. lictor* in this collection. There is extensive material of *Pitangus sulphuratus, P. lictor*, and *Myiozetetes cayanensis* in this collection and that the eggs of *Empidonomus varius* are not represented is to be expected, as the material was mainly collected in the neighborhood of Paramaribo where *E. varius* does not nest and where *P. lictor* is common.

I quote the measurements given by Hellebrekers:

Pitangus sulphuratus average of 50 eggs: 27.9 × 20.03 mm.
maximum: 32.4 × 19.6 mm.; 29.1 × 21.4 mm.
minimum: 24.2 × 18.7 mm.; 27.3 × 18.4 mm.
Pitangus lictor average of 50 eggs: 20.7 × 16.04 mm.
maximum: 22.9 × 16.2 mm.; 22 × 17.2 mm.
minimum: 18.7 × 16 mm.; 19.8 × 14.3 mm.
Myiozetetes cayanensis average of 50 eggs: 22.53 × 16.05 mm.
maximum: 25.6 × 17.8 mm.
minimum: 20.4 × 17 mm.; 20.1 × 14.4 mm.

These measurements correspond with my own experience, and the eggs Mr. Davis attributes to *P. lictor* are far too large for this species and fall within the range of *P. sulphuratus*, but only the collecting of one of the parent birds would have solved this problem as I did in my case.—F. Haverschmidt.

REVIEWS

Biology and Comparative Physiology of Birds. Volume I.—Edited by A. J. Marshall. 1960. Academic Press, New York and London. xii + 518 pp. $14.—The motivation for the production of this book is admirably stated by the editor in his preface. "I had become extremely bored with the frequent need to go back to the Victorian or Edwardian literature, or to translate from another language, whenever I wanted a relatively simple piece of information about a muscle, bone, the blood, gut or sense organs of birds." American readers, although perhaps not identifying dated literature by a sovereign of the period, have certainly shared the editor's exasperation and will be grateful that his boredom was turned to such good account. When volume II is published, A. J. Marshall will have given us, for the first time in this century, a reasonably complete and up-to-date account in English of the biology of birds.

I see little merit in comparing in detail this reference work with those of other eras or in other tongues. There will always be much to admire in earlier compilations, but there have been enormous advances in knowledge (particularly in physiology) since their time. And doubtless only a handful of the readers of this journal are proficient enough in French, German, or Russian to use with complete facility the recent or relatively recent source books in those languages. In this review, then, I will attempt to evaluate the work as though it were unique—which in some respects it is.

Volume I consists of 12 chapters dealing with the origin, adaptive radiation, classification, distribution, embryology, and various organ systems of birds. Each chapter exhibits a high level of scholarship, and I will give at the outset a blanket endorsement in the form of a paraphrase—every chapter is good, but some are a little bit better than others. There is a different author or pair of authors for almost every section, and this makes it advisable to consider each part separately. If some of the criticism seems picayunish, the reader is asked to bear in mind my comments on the over-all excellence of the entire work.

I. The Origin of Birds, by W. E. Swinton, provides a fine, concise summary of the characteristics of *Archaeopteryx*, its presumed antecedents, and the possible stages in the evolution of avian attributes. There is also some mention of the Cretaceous *Ichthyornis* and *Hesperornis*, but it is not clear whether the author believes that both were toothed, or just *Hesperornis*, or neither. The basis for questioning the presence of teeth in *Hesperornis* is not given.

II. Adaptive Radiation in Birds, by R. W. Storer, is an expert coverage of the major adaptive trends in birds from the Mesozoic to the present. Well-chosen illustrations complement this remarkably succinct treatment of a complex and extensive subject.

III. The Classification of Birds, also by Storer, includes a brief discussion of "adaptive radiation" in taxonomists from Linnaeus to the present, expressed in a reasonable and objective manner. There follows a classification of both fossil and recent birds down to the family level, with a nontechnical characterization of each family. These "thumb-nail sketches" also include "the geographic range, the number of species and genera, the known geologic range, and occasional comments on the relationship of the family where this is not implicit in the classification itself." The arrangement follows what Storer considers the best parts of the classifications of Wetmore (1951), Mayr and Amadon (1951), and some proposed changes based

on more recent data. There are no really radical departures from the systems most familiar to American ornithologists, but such changes as have been suggested are mentioned and some are adopted. *Archaeornis* is retained as a distinct genus (*contra* Swinton); the flamingoes are placed in a separate order; *Chamaea* is included in the Timaliidae; the "Fringillinae-Carduelinae" are considered to be ploceids; Beecher's division of the "Coerebidae" among the Parulidae and Thraupidae is recognized, and the arrangement terminates with the family Emberizidae —"buntings, New World sparrows, cardinal grosbeaks."

IV. Geographical Distribution of Living Birds, by D. L. Serventy, gives another well-balanced summary of present knowledge, and controversial and unsettled points are discussed. The number of widespread families of land birds that have not reached Australia may seem surprising to Neogean readers, but then the list of families absent from the Neotropical region will probably seem less surprising to such readers than to the Australian author. A noteworthy feature is the inclusion of data on the distribution of marine birds, a topic often neglected by zoogeographers.

V. Development of Birds, by Ruth Bellairs, will be especially welcome to ornithologists who have had little contact with embryology since taking an undergraduate course in that subject. The author opens with pertinent questions as to why birds have never developed viviparity, and after a suggested answer proceeds with a compact history of avian embryological studies. Then there is a detailed account of development from the fertilized egg through early stages of all the organ systems. Numerous illustrations aid in the visualization of these processes. Among the many useful parts of this chapter are the discussions of inductive processes in the bird (instead of the better-known amphibian) and the utilization of yolk by the developing embryo. Most of the data are necessarily derived from the domestic chick. One can appreciate the need for working with such an easily available form on reading of the technical difficulties faced by experimental embryologists. For example, studies on the effect of removal of the pituitary may give uncertain results as the gland is removed by decapitation of the embryo. The author dutifully notes (p. 179) that headless embryos, although living, are incapable of hatching because of the absence of the egg caruncle.

VI. The Integumentary System, by M. E. Rawles, deals principally (as it should) with feathers. On the subject of their development, growth, and pigmentation the author is on sure ground, and she provides the best available summary of these processes. There is some evidence, though, that the author's familiarity with birds is more or less restricted to the domestic fowl. One of the valuable aspects of this chapter is that it points up the need for analysis of the control of pigmentation in more and different avian species.

VII. The Skeleton of Birds, by A. D. A. Bellairs and C. R. Jenkin, includes in the opening paragraph the observation that "one has the impression that knowledge of the subject [avian osteology] was much more widespread during the nineteenth century than it is at the present time." The authors' treatment of the skeleton needs no apologies to past centuries, for their discussion manages to be general, detailed, and comparative. There are many excellent illustrations. If there is some emphasis on the skull, it must be admitted that this is a most complex part of the skeleton. Apart from a brief section on the use of the bony palate in classification, there is little reference to osteological studies in relation to systematics. Although the unusual hyoid specializations of woodpeckers are deservedly admired

(p. 279), there is no mention of the similar developments in hummingbirds. The complexities and open questions regarding skeletal pneumaticity are of special interest, and it is regrettable that reference to some of the most successful recent techniques (such as Tompsett, 1957, *Ibis*, 99: 614–620) could not be included. The authors' justifiable nostalgia for the anatomical expertise of the nineteenth century may be unconsciously responsible for the frequent use of Edwardian or other obsolete scientific names—references to *Plotus, Parra, Palamadea, Tinnunculus*, etc. could surely have been brought up to date by a little checking. None of these minor criticisms really detracts from the over-all excellence of treatment.

VIII. The Musculature, by A. J. Berger, is a predictably expert descriptive account, with thorough attention to important details and with excellent illustrations. The discussion is largely restricted to the major skeletal muscle groups, particularly those associated with the appendages. Readers will share the author's regret that space limitations did not permit any detailed interpretation of phylogeny and relationships as suggested by myology. The presence or absence of certain muscles or patterns of attachment in totally unrelated forms (for examples, see pp. 331 and 333) may dismay the nonanatomist, but it makes him even more eager for a discussion of the functional significance, if any, of these similarities and variations.

IX. The Blood-Vascular System, by J. R. Simons, is short and almost entirely anatomical. There is a detailed treatment of the heart, descriptions of the position and function of the major blood vessels, and a list of the kinds and characteristics of different blood cells. Except for the account of the carotid arteries, there is no indication of how much variation (if any) there is in the pattern of major vessels in different avian groups. Kern is given as the source of the drawings of the heart, but his work is not listed in the bibliography at the end of the chapter. If the paucity of physiological information on the avian circulatory system is as great as this chapter suggests, there is indeed a vast and scarcely touched field open for investigation. One example: what are the characteristics of avian cardiac muscle that permit heart rates of 1,000 per minute?

One other question—when the author of a review paper such as this finds the data of two contemporary investigators in glaring conflict (p. 346), should he not consult both authors and attempt to find an explanation? This would be of much greater profit to the reader than the mere pointing out of a striking discrepancy.

X. The Respiratory System, by G. W. Salt and Erik Zeuthen, is long and thorough, treating anatomy, respiratory mechanics, nervous control, and physiology. There is a mine of good information and discussion here, bolstered by ingenious calculations. This chapter will be one of the most useful to avian physiologists as the authors have interpreted respiration broadly and their coverage is correspondingly wide ranging. They have also given additional cause for biologists to marvel at the career of William Harvey, whose publications as cited here span just over 300 years (1651 to 1952).

XI. Digestion and the Digestive System, by D. S. Farner, must be singled out both for its high quality and its comprehensiveness. This chapter is a veritable encyclopedia on avian digestion and represents an astonishing coverage of more than two centuries of world literature as well as the author's own research. If desperate to find something to criticize, one may suggest that pellet-forming and disgorging deserve more than bare mention (p. 433), and that *Colymbus* (p. 446) is used as a generic name (as it is in several other chapters). Like the preceding one, this chapter will be particularly valuable to avian physiologists.

XII. Excretion, by Ivar Sperber, covers the gross and microanatomy of the kidney and especially its functioning. Those who take their physiology straight will perhaps be more enthusiastic than those who would prefer an attempt to relate the specializations of avian renal function to the needs of the bird in nature. Still, one should not cavil at so authoritative an account of a complex system that does not fall easily to investigation, and ecologists can be thankful for the rich source of basic information provided. A little more elaboration at some points would be helpful to the general reader—the significance of the mitochondria in the tubule cells (p. 474), or the form in which material excreted as semisolid uric acid is transported across cell membranes are two examples that come to mind. There is apparently some disagreement between Simons (p. 357), who considers the renal portal system not significant as such, and Sperber (p. 478), who seems to feel that it is. The chapter concludes with mention of the recently discovered extra-renal salt excretion by the nasal gland in marine birds.

A few general comments are in order in conclusion. The frequent use in various chapters of obsolete scientific names is a minor but unnecessary flaw. Although the syrinx merits detailed attention, it receives only brief mention in the sections on musculature and on respiration; apparently this organ was not considered a special responsibility by any of the authors. The illustrations are invariably well executed and helpful, and the bibliographies at the end of each chapter would alone constitute a valuable contribution. The volume as a whole is a landmark in twentieth-century ornithology, and everyone seriously interested in avian biology should familiarize himself with this book. A. J. Marshall and all the contributors are to be congratulated, and ornithologists everywhere will hope for the early issuance of volume II.—THOMAS R. HOWELL.

Vogeltrek.—4th Edition. G. J. van Oordt. 1960. E. J. Brill, Leiden. xi + 195 pp., 44 figs. *ca.* $3.00.—Eleven years have elapsed since the publication of the third edition of this very useful general treatise of migration. These 11 years constitute a period of extensive advances in research on migration, especially from the aspects of orientation and metabolism. These advances in our knowledge of migration have been sufficiently incorporated in this new edition to maintain its position as the best general nontechnical treatise of migration. The first chapter (pp. 1–18) deals primarily with generalities and definitions and is essentially the same as in the previous edition. The second chapter (pp. 21–94) presents the various empirical aspects of migration—migratory routes and schedule, contributions of banding investigations, day and night migrants, invasions, broad-front and restricted-front migration, etc. This chapter has been extensively rewritten and its illustrations improved. The third chapter (pp. 95–112) reviews the difficult and controversial subject of the influence of meteorologic conditions on migration, with attention primarily to wind and temperature. Clearly in the more typical spring and fall migratory patterns we are confronted with the superposition of weather-induced influences on the more basically established internal changes that exert the compelling tendency to migrate. Included in this chapter also are reverse migration, late-summer movements, and the so-called *vorstvlucht* of Vleugel associated with food shortage in very cold periods. The fourth chapter (pp. 115–132), with its semantically unsatisfactory title, *Het Trekinstinct*, is concerned largely with the physiologic basis of the migratory state and with the stimulation and timing thereof. As in the previous editions, the author has included this chapter in the *Theoretisch Gedeelte* of the book. In a number of ways this chapter is not up to the standard

of the other chapters, although I do sympathize with the author in the difficulty of effecting a satisfying analysis of the almost explosive number of pertinent publications of the past decade. It is my feeling that there is now sufficient knowledge at hand so that these matters need be regarded as no more *theoretical* than most aspects of the effect of weather on migration. The final chapter (pp. 133–171), also included in the *Theoretisch Gedeelte,* is concerned with orientation in migration. It has been extensively rewritten in light of recent research and presents a sound synthesis of the known orientation and homing abilities of birds (young and adult), the empirical experiments that define these abilities more precisely, and the more recent experiments that delve into the mechanisms involved. This revision of *Vogeltrek* allows it to continue to be the best general treatise on bird migration; an English edition would be of very great importance in extending its usefulness.—D. S. FARNER.

The Birds of Finca "La Selva," Costa Rica: A Tropical Wet Forest Locality.—Paul Slud. 1960. Bull. Amer. Mus. Nat. Hist. vol. 121, art. 2, pp. 49–148; maps, text figs., photo. pls. $2.75.—This is a welcome ecological study of the birds in an area of 1,500 acres in the northeastern lowlands of Costa Rica. After previous experience in that country, the author spent a full year in the selected area observing the birds, in preparation for this doctoral dissertation submitted to the University of Michigan. A preliminary review of the local environment and habitats and of foraging habits introduces the more detailed information. An annotated list indicates the habitat niche of the 331 species observed, their seasonal status and abundance ("common," "uncommon," "rare"), and whether occurring alone, in pairs, or in groups. A separate ecological classification lists the species in each habitat, subdividing the major habitats into convenient vertical strata. Included are comments on the foraging behavior of many species. A table of migrants shows the months of observation in the area. Considering the paucity of information on neotropical birds, all this is especially useful to the increasing body of students of this rich avifauna.

General readers will find the final section of the work controversially thought provoking and interesting. The author takes issue with the emphasis on a hypothesized former independent "North American tropical fauna" as a source of North American birds. He argues that since ancient times the neotropical region, centering in tropical South America, has been a reservoir and fount of the American avifauna. Advances and retreats of neotropical birds into peripheral areas (including North America) have depended on fluctuating climatic cycles, which directly affected vegetation on which birds depend. He also vigorously attacks the notion that the American suboscines (Tyranni) are competitively inferior to and are being replaced by the oscines (Passeres). Using a comparative table, he urges that while the proportion of suboscines to oscines decreases as one leaves the Amazonian center of the neotropics (where two-thirds of the Passeriformes are suboscinine), the suboscines are not replaced by oscines, but rather the total of species is reduced. The suboscines, he finds, are primarily birds of the humid tropical forest, and the extent (as well as the complexity) of this environment, with its variety of niches, is markedly reduced as one proceeds northward and southward. This reviewer agrees with the author that the American suboscines show no competitive disadvantage. In the Neotropical Region (and to some extent in North America) they maintain themselves in niches occupied in the Old World

by oscines. It is an interesting fact, however, that although many suboscinine tyrannids and furnariids have adapted to open, and even terrestrial, environments, the great majority of the suborder remain predominantly insectivorous (though some, particularly in the Cotingidae, are mainly frugivorous). Despite the wide extent of grassland in the neotropics, there seem to be no *essentially* granivorous suboscines; the seed-eating niche is left to the oscines even in South America. There is no evidence that suboscines ever occupied that niche, but their failure to do so may indicate that their adaptive potential is less than that of the oscines. Slud's well-written and stimulating discussion serves as a needed counterpoise to the tendency of northern ornithologists to forget that for birds, as for insects and plants, the temperate zones are submarginal areas.—E. EISENMANN.

Vergleichend morphologische Untersuchungen am Vorderhirn der Vögel auf cytologischer und cytoarchitektonischer Grundlage.—Werner Stingelin. 1957. Helbing and Lichtenhahn, Basel, Switzerland. 123 pp. 32 figs.—Stingelin has produced a beautiful monograph on the avian forebrain. One of his main interests is the study of homology, and he discusses from a number of angles whether or not the forebrain of the bird contains a structure homologous to the neocortex of the mammal. In an earlier publication (1955) he answered this question with a definite affirmative. In this more extensive monograph, after collaboration with Haefelfinger (1958) on embryological aspects of the problem, he has considerably modified his conclusions.

Some investigators, like Kappers, have not taken much interest in comparing the brains of different families of birds because there is less difference in surface anatomy among birds than among different mammals. The extensive uniformity of avian brains seemed to make it unlikely that one would get anything out of a study of the cyto-architecture. But Stingelin, working in Portmann's laboratory in Basel, was impressed with the latter's quantitative work on the bird's forebrain, which gave an index of cerebralization. This index has important bearings on two other main subjects of the book: evolutionary development and the rank order of intelligence of different kinds of birds. Because the forebrain is composed of variable elements, the index can be used only as a general expression of the degree of development of the nervous system. Therefore, Stingelin believes that the different parts of the forebrain must be analyzed quantitatively. He adds that the comparison of the external form and the cyto-architecture of the forebrain (on the one hand) with its size (on the other hand) is an especially rewarding endeavor. The solid forebrain of birds has fundamentally different evolutionary possibilities from the flat, cortical structure of mammals. In birds one does not look for convolutions, but observes the sculpture of the mass and the complex integration of the different parts of it, as well as its cytological differences and histological relationships. He thus introduces his objectives and goes on to present his evidence, based on the brains of 51 species of birds of 11 different orders. Twenty-five of these were cut in serial sections.

Stingelin's most important contribution is found in Part III, "The Differentiation of the Hemisphere." Here he describes and illustrates with many fine figures the fact that the ganglia that make up the striatum vary greatly in size, position, and cell structure in different families of birds. It has long been known that the hemispheres of the forebrain consist almost entirely of large basal ganglia, which collectively have usually been called "striatum." The principal ganglia are paleostriatum, archistriatum, neostriatum, hyperstriatum (ventral, dorsal and accessory),

the nucleus intercalatus, and the nucleus basalis. In addition there is a well-developed hippocampus (archicortex) and three corticoid areas, which are poorly developed and superficial. The degree of differentiation of these ganglia, corticoid areas, and the hippocampus is certainly variable and must have important implications. The variation is least in the paleo- and archi- and most marked in the neo- and hyperstriatum, especially in the "Wulst," which is composed of *hyperstriatum accessorium and dorsale* and *n. intercalatus*. The author believes that the study of the integration of the different parts of the telencephalon is the way to throw light on the evolutionary development of the avian brain. In order to compare the forebrains of different species more effectively, he makes a serious, though complicated attempt at quantitation. This is difficult to do because it is hard to choose the elements to be measured, and hard to make objective measurements.

The attempts at quantitative analysis seem to this reviewer to belabor the problem. They do not show as much as the drawings. The one thing brought out clearly is that there is little difference among species in the phylogenetically older ganglia and more in the more recent ones.

Obviously the difficulties of comparing the ganglia of one species with those of another are great, especially when one tries to measure the size of a ganglion and the size and concentration of nerve cells. In addition, the author rightly points out that in each bird the size and position of a ganglion must be compared with a more constant part of the brain. Accordingly he takes Portmann's brain stem *(Stammrest)* as a relatively stable topographical basis and on this builds a model of a primitive avian brain *(Grundtypus)* with which he compares 18 different species. A parrot *(Amazona ochrocephala)* and a crow *(Corvus frugilegus)* are described at length as two very differently constructed, but highly developed types of forebrain, illustrating convergent evolution. In comparing a highly developed brain with the "Grundtypus," the following main features are important: (1) Increase in size of the hemispheres; (2) Reduction of olfactory bulb; (3) Decrease of archi- and paleostriatum; (4) Caudal shift of lateral ventricles; (5) Reduction of nucleus basalis; (6) Enlargement and differentiation of *Wulst;* (7) Reduction of area praepyriformis. The systematic comparison of these seven points shows that convergent evolution can take place from a behavioral standpoint with quite different types of organization of the striatal ganglia. *Amazona* is greatly changed in the fronto-parietal area, but in the basal parts resembles the "Grundtypus," while *Corvus* is strongly developed in the basal and frontal parts, but in the occipito-parietal parts is relatively archaic.

In the chapter entitled "Comparison and Extent of Striatal Fields" (pp. 33 to 70), there is a comparative description of the ganglia in 18 species with clear diagrams of each. In the "developed" species there is a tendency to marked frontal enlargement. This is achieved in two ways: A. The frontal pole is made up of the *Wulst*, the rostral end staying in contact with the *Bulbus olfactorius*. B. The frontal pole is made from the neostriatum and ventral hyperstriatum, the *Wulst* having reached a position on the vertex by successive caudal shifts. In both A and B as the *Wulst* becomes larger, there is a more-conspicuous differentiation of the cells in the ganglia. From these important observations Stingelin deduces a morphological rank in relation to the "Grundtypus." This concept is elaborated in Part IV, "The Analysis of Form." In developmental line A, crows and owls are considered the more highly developed groups; in line B, the higher ones are snipe,

spoonbill *(Platalea)*, and parrot, with a plover considered as "lower" and the lapwing as "middle." This rank order seems to be entirely based on cerebral anatomy; no mention is made of body posture, cerebral axis, anatomy of the skull or behavioral criteria.

In Section IV, "The Analysis of Form," there is a chapter on "Form and Sculpture" (pp. 87–109), in which is described and illustrated by beautiful photographic plates the surface anatomy (dorsal, lateral and ventral) of 43 species from 11 different orders. Here is an atlas of great value.

Under "Discussion of Results" (pp. 109–119) the author gives his theories about the evolution of the bird's brain. He emphasizes the importance of new structures such as the *Wulst*, which in the lizzard *Varanus* shows only a primordial anlage. He also points out that the differentiation of the reptilian neostriatum into the avian neo- and hyperstriatum is a new development, along with the *Nucleus intercalatus*, which goes through an extraordinary differentiation. He states that his cyto-architektonic analysis has led to the formulation of laws of construction that make possible the classification of the types of hemisphere into two divergent directions of evolution, "A" or "B." When the observed forms do not seem to fit the proposed evolutionary sequences, he explains the discrepancies by the concept of vertical modification (makro-evolution) as contrasted with horizontal modification (mikro-evolution).

The presentation in this book fills the need for a systematic description of the construction of the avian cerebral hemisphere. The evolutionary and taxonomic implications of the work may be of some importance, but need verification through more cytological studies to clarify the homologies.—Stanley Cobb.

Ptitsy SSSR. Tom. IV. [Birds of the USSR, Part IV.] L. A. Portenko. 1950. Zoological Institute of the Academy of Sci. USSR., Moscow. 414 pp. 24,85 Rub.—This volume deals with the remainder of Passeres, the XXth order of birds, thus being the final volume on Passeres. There is a key to the families of Passeres in USSR. It includes the following families: Sylviidae, Regulidae, Muscicapidae (subfamilies Muscicapinae and Monarchinae), Prunellidae, Motacillidae (subfamilies Motacillinae and Anthinae), Bombycillidae (subfamily Bombycillinae), Laniidae (subfamily Laniinae), Sturnidae, Zosteropidae, Parulidae, Ploceidae (subfamily Passerinae), Icteridae, Fringillidae (subfamilies Fringillinae, and Carduelinae), and Emberizidae.

There is a supplement to Part III, an index of Russian and scientific names as well as of synonyms. In each family there is a key to the genera.

The relatively numerous nomenclatorial changes, based on extensive material in collections, are not in accordance with Wetmore's system. Some examples: genus Carpodacus has been divided into *Rubicilla* for the red holarctic and *Erythrina* for the rose Asian species. The former *Carduelis spinus* is separated into genus *Spinus*, the Linnets into genus *Linaria*, etc. The descriptions and keys are good, as are also the drawings.—F. J. Turček.

Der Flug der Tiere.—Edited by Herta Schmidt. 1950. Verlag Waldemar Kramer, Frankfurt am Main. 164 pp., 174 illus.—In conjunction with the Internationale Luftschiffahrts-Ausstellung in Frankfurt am Main in 1909, the Senckenbergische Naturforschende Gesellschaft presented a display, "Flugorgane der Tiere und Pflanzen," on biological flight. On the fiftieth anniversary of this exposition a special display, "Der Flug der Tiere," was presented in the Senckenberg Museum.

This was accompanied by a similarly named number of the Museum's popular journal *Natur und Volk*, which has been revised and enlarged into this book. The result is a most useful small volume on the biology of flight. The initial chapter by Dr. Wolfgang Struve is concerned primarily with the evolution of flight in aquatic animals, insects, reptiles, birds, and bats. This is followed by a most useful chapter on flight in insects by Dr. Elli Franz, an excellent chapter on flight in birds by Dr. Joachim Steinbacher, and a most interesting discussion of flight in bats by Dr. Heinz Felten. All three of these chapters present the empirical and mechanical aspects of flight, although, in general, the problems of energetics and control are not considered. The book closes with brief chapters on the aerial movements of amphibians and reptiles (Professor Dr. Robert Mertens), thread-spinning spiders (Dr. Otto Kraus), and "flying" aquatic animals (Dr. Wolfgang Klausewitz). The book is replete with useful and well-chosen illustrations.—D. S. FARNER.

The Christopher Happoldt Journal; His European Tour with the Rev. John Bachman (June-December, 1838).—Edited by Claude Henry Neuffer. 1960. Contributions from the Charleston Museum XIII. 214 pp. + unpaged index. The Charleston Museum, Charleston, S. C. $5.00.—In 1838 John Bachman, preacher, civic leader, and distinguished naturalist, left his adopted city of Charleston and toured Europe, ostensibly for his health. Whatever the effects of seven months of hard work and harsh travel, the tour resulted in the diary of Christopher Happoldt, a 14-year-old Charlestonian, who accompanied Bachman. Bachman's own record of the trip was unfortunately destroyed in the burning of Columbia near the end of the Civil War.

This work consists of three parts. A biographical sketch of Christopher Happoldt himself occupies 12 pages. Then comes a pleasant surprise that the reader is totally unprepared for by the title, a biography of John Bachman filling 90 pages. The remaining 95 pages of text are taken up with an annotated transcription of Happoldt's diary.

Neither the biography of Happoldt nor his journal is of much value to the naturalist, although they are admirable in their own way. The meat of the book is the point where Professor Neuffer leaves off being editor and becomes the author of the biography of John Bachman. This is the only serious recent effort at the full-length story that Bachman so richly deserves. Neuffer acquaints us with the major printed sources of information on Bachman and quotes freely from unpublished Bachman letters in the Charleston Museum. A fine portrait of Bachman is included.—DANIEL MCKINLEY.

Symposium on Energy Balance.—*The American Journal of Clinical Nutrition*. 8 (5): 527–774. 1960. The American Journal of Medicine, Inc., 11 East 36th Street, New York.—This number includes the papers and discussions of the Symposium on Energy Balance, organized by Jay Tepperman and John R. Brobeck, and sponsored by The Upjohn Company, at Brook Lodge, Augusta, Michigan, in September 1959. The symposium was concerned basically with problems of energy intake, appetite, and most extensively with fat deposition and fat metabolism. There were 28 formal papers, accompanied invariably by extensive discussions. Of direct interest to ornithologists is "Premigratory hyperphagia in birds," by Eugene P. Odum. This paper summarizes well our knowledge of the nature of premigratory fat deposition and relates this knowledge to the general problem of fat

deposition in animals. Beyond this paper, however, the serious student of the physiology of migration will find much of importance to aid in his thinking and planning of experiments. These include papers on such subjects as effects of glucagon on metabolism, appetite and satiety, mechanism of fatty acid synthesis, metabolism in adipose tissue, and hormonally induced obesity.—D. S. FARNER.

Das Tierreich. VII/5. Vögel.—Hans-Albrecht Freye. 1960. Sammlung Göschen, Band 869. Walter de Gruyter, Berlin. 156 pp., 69 fig. D.M. 3.60.—As a condensed general review of the biology and systematics and biology of birds, this little volume is remarkably good. Indeed it is difficult to imagine how it would be possible to do more in the same number of pages. The shortcomings are primarily those of excessive condensation. The treatments of skeleton and integument are perhaps the most effective, whereas that of the endocrine system is relatively weak. The systematic section (pp. 103–145) recognizes 32 orders.—D. S. FARNER.

The Birds of West-Central Ellesmere Island and Adjacent Areas.—David F. Parmelee and S. D. MacDonald. 1960. National Museum of Canada, Bull. No. 169, 85 pp. 2 figs., 10 plates. $1.50.—This is an important contribution to the breeding biology of the birds of Arctic North America. It is based on studies by the authors during the period of 16 April–27 September 1955. The extensively annotated list contains 23 species, of which 20 had been previously recorded; nests of 15 species have been recorded. The observations and specimens obtained are carefully related to previous investigations in this and other areas of the American Arctic.—D. S. FARNER.

Hypothermia and the Effects of Cold.—A. S. Parkes, Editor. *British Medical Bulletin*, Vol. 17, No. 1, 73 pp. 65 Davies Street, London, W. 1. $3.25.—This number consists of 18 review papers, which cover a very substantial fraction of the aspects of this interesting field. Seven of the authors are Canadian; the remainder are from the United Kingdom. Of particular interest to biologists are "Resistance of Poikilothermic Animals to Cold," by R. W. Salt, "Hibernation in Mammals and Birds," by L. Harrison Matthews, "Physiological Effects of Continued Cold on Animals and Man," by J. S. Hart, and "Biochemical Changes in Exposure and Acclimation to Cold Environments," by F. Depocas. Collectively, these reviews contribute much to an understanding of the physiologic requirements for existence in low temperature and the kinds of changes and adaptations that occur with hypothermia. There is unfortunately a pronounced bias toward English-language literature. Nevertheless, this is a most useful collection of reviews, and the *British Medical Bulletin* is to be commended for its insight and efforts in assembling and publishing it.—D. S. FARNER.

Bird-Banding. Index to Volumes XII–XXI. 1941–1950.—Margaret B. Hickey. 1960. Published by the Northeastern Bird-Banding Association with the assistance of the Eastern Bird-Banding Association and the Inland Bird-Banding Association. Available from Mrs. James B. Downs, South Londondery, Vermont. iv + 247 pp.—This index is indeed an important contribution to ornithological literature. It makes more readily available the important original papers and notes in this journal; furthermore, because the reviews also have been indexed, it will be useful as an index to much of the important ornithological literature of the world for this period. Entries are made by geographic localities, subjects, species,

and authors. Mrs. Hickey is to be commended for this important contribution to ornithology.—D. S. FARNER.

Binoculars and Scopes and Their Uses in Photography.—Robert J. and Elsa Reichert. 1961. Modern Camera Guide Series, Chilton Company, Book Division, 56th and Chestnut Sts., Philadelphia 39, Pennsylvania. 128 pp., 55 figs. Paper, $1.95; cloth, $2.95.—This is an amazingly well-conceived nontechnical discussion of binoculars and scopes with primary attention to their construction, functional features, performance, operation, and care. I cannot overemphasize its potential value to anyone who has, or plans to procure, such an instrument, since only a minute fraction of ornithologists, amateur or professional, are really adequately informed in such matters. This little book provides the benefit of much important experience gleaned from many years of operation of the well-known Mirakel Optical Company.—D. S. FARNER.

Bucerotidae (Aves/Upupae).—Kurt Sanft. 1960. *Das Tierreich*, Lieferung 76: 1–174. Walter de Gruyter, Berlin. 106 fig. DM 3.60.—As throughout *Das Tierreich*, this treatise is primarily systematic with limited introductory material on the distinguishing characteristics, anatomy, ecologic adaptations, food, breeding habits, molt, parasites, and evolution of the hornbills. The systematic section (pp. 11–137) is provided with keys, tables of measurements, diagrams, and maps. The author recognizes 14 genera, 44 species, and 76 subspecies as compared with the 12 genera, 46 species, and 87 subspecies recognized by Peters (*Birds of the World*, Vol. 5, 1945). The major change in this monograph, aside from the smaller number of subspecies accepted, is the restoration of *Tropicranus* W. Sclater for the West African species, *albocristatus* Cassin, and *Rhyticeros* Reichenbach for a group of oriental species—*leucocephalus* Vieillot, *corrugatus* Temminck, *cassidix* Temminck, *undulatus* Shaw, and *plicatus* J. R. Forster. Of very substantial value is the list of ecto- and endoparasites (pp. 5–11). This is a commendable and most useful monograph.—D. S. FARNER.

Birds of North Carolina.—T. Gilbert Pearson, C. S. Brimley, and H. H. Brimley. Revised by David L. Wray and Harry T. Davis. 1959. North Carolina Department of Agriculture, State Museum Division, Raleigh. xxvii + 434 pp., 97 figs., 47 plates (many in color). $5.00.—This book was first published in 1919 and revised in 1942. The present revision is largely a reprint of the 1942 edition with some minor deletions and the addition of several new plates by Roger Tory Peterson. For most species a short paragraph has been appended giving recent observations compiled by the revisers. Twelve new "kinds" of birds have been added to the state list since the last edition. Although it is stated that the present edition is up to date for 1959, one notes the use of certain generic names not applicable according to the latest A.O.U. *Check-list; viz, Colymbus, Cygnus, Pelidna, Ceophloeus, Dryobates, Otocoris*, and *Corthylio*. However, in general, the terminology is quite up to date. The high quality of paper, binding, text, and illustrations combine to make this one of the best bargains in bird books in many years.—G. E. HUDSON.

RECENT LITERATURE

EDITED BY FRANK McKINNEY

Behavior

Davis, J. 1960. Nesting behavior of the Rufous-sided Towhee in coastal California. Condor, **62:** 434–456.—Detailed, long-time observations of relatively few nests. Data on such topics as nests, eggs, incubation. Most pairs rear one brood; female builds nest, incubates, and broods alone.—R. E. P.

Goethe, F. 1957. Das Herabstarren, eine Übersprungbewegung bei den Lariden. Behaviour, **11:** 310–317.—The behavior pattern of "staring down" occurs in many members of the Laridae and Limicolae. It often occurs in conflict situations and is thought to be the formalized part of displacement pecking and/or displacement preening.—F. M.

Hailman, J. P. 1960. Hostile dancing and fall territory of a color-banded Mockingbird. Condor, **62:** 464–468.

Iersel, J. J. A. van and A. C. A. Bol. 1958. Preening of two tern species. A study on displacement activities. Behaviour, **13:** 1–88.—A very detailed analysis of preening in *Sterna sandvicensis* and *S. hirundo*, with important theoretical discussions. Preening after bathing involves a number of movements that tend to occur in a certain order. Different threshold values are postulated for each movement, and this leads to conclusions about fluctuations in the strength of the "preening drive." Displacement preening in conflict situations (*e.g.*, between brooding and escape, attack and escape) is analyzed. Displacement activities may occur even when there is no overt expression of the conflicting drives. A new "disinhibition hypothesis" is developed in place of the former "sparking over" concept: a conflict results in mutual inhibition of the two drives and "allows" expression of another drive.—F. M.

Lehrman, D. S. and R. P. Wortis. 1960. Previous breeding experience and hormone-induced incubation behavior in the Ring Dove. Science, **132:** 1667–1668.—"Injected progesterone induced incubation behavior much faster, and in a higher percentage of cases, in doves [*Streptopelia risoria*] with previous breeding experience than in those without such experience. The nature of the animal's previous experience is thus one of the variables influencing behavioral responses to exogenous hormones." (Authors' abstract.)

Lind, H. 1959. The activation of an instinct caused by a "transitional action." Behaviour, **14:** 123–135.—Part of a behavior pattern that is common to two activities may cause a transition from one activity to the other, *e.g.*, feeding, nest building, and diving during the precopulatory neck dipping of Cygninae, Anserini, and the *Casarca* groups of waterfowl.—F. M.

Marler, P. 1957. Specific distinctiveness in the communication signals of birds. Behaviour, **11:** 13–39.—Releasers involved in reproductive isolation tend to be divergent between closely related sympatric species (*e.g.*, pair-formation displays). Releasers of sympatric species with functions that discourage specific distinctiveness often converge on common types (*e.g.*, alarm calls). Both of these types of releaser may be of limited value as taxonomic characters. Releasers selected for moderate specific distinctness, with both intra- and interspecific functions (*e.g.*, preflight and aggressive displays), are useful characters indicating relationships on the generic or family level.—F. M.

Marler, P. and D. Isaac. 1960. Song variation in a population of Brown Towhees. Condor, **62:** 272–283.—Detailed sonogram analyses of 55 songs of 31 individuals for temporal pattern, frequency, and syllable structure.—R. E. P.

Morris, D. 1957. The reproductive behaviour of the Bronze Mannikin, *Lonchura cucullata*. Behaviour, **11:** 156–201.—Fighting, nesting, pair formation, and copulation are described and comparisons made with other Estrildine finches. Many theoretical problems are raised, and special discussions are devoted to displacement activities, the derivation and motivation of displays, and the effects of introducing new birds to an aviary colony.—F. M.

Moynihan, M. 1958. Notes on the behavior of some North American Gulls. II. Non-aerial hostile behavior of adults. Behaviour, **12:** 95–182.—Most attention is given to the Ring-billed Gull and Franklin's Gull, with brief notes on California Gull and Bonaparte's Gull. Detailed description and analysis leads to a discussion of the motivation of hostile behavior patterns. All are thought to result from simultaneous activation of attack and escape drives; each pattern is produced by a certain combination, variations occurring in absolute and relative strength of the two drives. The evolutionary origin and signal functions of the displays are discussed. Comparisons are made with the behavior of other gull species, and an attempt is made to reconstruct the hostile repertory of the ancestral gull.—F. M.

Moynihan, M. 1958. Notes on the behavior of some North American Gulls. III. Pairing behavior. Behaviour, **13:** 112–130.—Describes pair formation and later pairing behavior (including copulation) in Franklin's Gull and Ring-billed Gull with some notes on Laughing Gull, Bonaparte's Gull, and the American Herring Gull. Pair formation begins with hostile displays between the sexes that gradually diminish as sexual patterns appear.—F. M.

Raitt, R. J. Jr. 1960. Breeding behavior in a population of California Quail. Condor, **62:** 284–292.—Includes descriptions of flock behavior and histograms of time of laying, incubating, and hatching.—R. E. P.

Simmons, K. E. L. *et al.* 1960. Notes on anting by British Passerine birds in the wild. Brit. Birds, **53:** 11–25.—A five-page introduction by Simmons is followed by 14 short notes by other observers. New information is presented on many aspects of anting, including details of the ant species that have been recorded. —F. M.

Smith, W. 1957. Social "learning" in domestic chicks. Behaviour, **11:** 40–55.—Experiments demonstrating social facilitation and the special case of "mimicry" (where the performance of an untrained chick is improved by the presence of a trained chick).—F. M.

Thompson, W. L. 1960. Agonistic behavior in the House Finch. Part I: Annual cycle and display patterns. Condor, **62:** 245–271.—Based on both wild and captive subjects. Little aggression in loose winter flocks but increases to peak in spring during pair formation. Males defend area around nest and female but not a rigid territory. Illustrated descriptions of displays.—R. E. P.

Thompson, W. L. 1960. Agonistic behavior in the House Finch. Part II: Factors in aggressiveness and sociality. Condor, **62:** 378–402.—In caged birds aggressiveness increased as space per bird decreased. Males were more aggressive than females in spring, and captive flocks show well-defined social hierarchy. —R. E. P.

Tschanz, B. 1959. Zur Brutbiologie der Trottellumme (*Uria aalge* Pont.). Be-

haviour, **14:** 1–100.—The behavior of the Guillemot in relation to its incubation site, eggs, and chicks is described in detail. Experiments on egg color and pattern show that both are important in enabling each bird to identify its own egg. Adaptation to a new color and pattern can be induced, but the change must be gradual. Incubation activities are influenced both by the egg and the site. Egg rolling occurs in the "incubation area" and the "egg-rolling area" when the egg closely resembles the bird's own, but rolling is inhibited in foreign areas and with foreign eggs. The feeding and protection of the young are described. Auditory signals are important in keeping contact between parents and chick. Special attention is given to the behavior associated with the chick's departure from the ledge.—F. M.

Distribution and Annotated Lists

Anon. 1960. Additions to the British and Irish list: White-throated Sparrow, Black-and-white Warbler, and Olive-backed Thrush. Brit. Birds, **53:** 97–99.

Davis, J. 1960. Notes on the birds of Colima, Mexico. Condor, **62:** 215–219. —Annotated list.

Fawks, E. 1960. A survey of wintering Bald Eagles. Iowa Bird Life, **30:** 56–58. —The decline of eagles in the Tri-City area of Iowa and Illinois.—E. E.

Hall, B. P. 1960. The faunistic importance of the Scarp of Angola. Ibis, **102:** 420–442.—Evidence is presented that the Scarp of Angola is (1) a center of speciation, (2) an important barrier between two drier zones allowing subspecies to develop in each, and (3) a region where endemic or nearly endemic species of birds occur. The geography, climate, and vegetation are discussed, as well as the avifaunal zones of Angola. Thereafter, species providing evidence for each of the above three proposals are discussed one at a time, including data on characters and ranges and an *interpretation* relating evolution of the species to the proposed influence of the Scarp.—J. W. H.

Hebard, F. V. 1960. The land birds of Penobscot Bay [Maine]. Portland [Me.] Soc. Nat. Hist., 39 pp.—A local list.

Kenyon, K. W. and J. W. Brooks. 1960. Birds of Little Diomede Island, Alaska. Condor, **62:** 457–463.—Annotated list.

Mountfort, G. 1960. Opportunities for co-operation with French ornithologists. Brit. Birds, **53:** 193–199.—Discusses some of the gaps in knowledge of bird distribution in France and suggests contributions that can be made by visiting ornithologists.—F. M.

Nisbet, I. C. T. 1960. Notes on the American Purple Gallinule. Brit. Birds, **53:** 146–149.—Notes accompanying the announcement of the first European record, an exhausted bird found on the Isles of Scilly, 7 Nov. 1958.

Nisbet, I. C. T. 1960. Notes on the Rose-breasted Grosbeak. Brit. Birds, **53:** 150–152.—Notes accompanying the announcement of the first European record, an adult male seen in Northern Ireland, 24 Nov. 1957.

Novikov, G. A. (ed.). 1960. Trudy Kandalkshskogo gosudarstvennogo zapovednijika. (Scientific works of the Kandalaksha state reservation.) Vol. II. Murmansk book publishers, pp. 336.—The volume contains five papers, as listed below; the faunistic and ecological material from a reserve in northwest USSR is interesting for comparison with other subarctic regions. Blagosklonov, K. N., Birds of the Kandalaksha reserve and the vicinity of the White Sea biological station of Moscow University; Bianki, V. V., Flerov, A. I., A list of birds of

Kandalaksha Bay and its shores; Bianki, V. V., Nonbreeding auks (Alcae) in Kandalaksha Bay; Kashinskiy, A. A., A contribution to the fauna and ecology of birds of the Teribersk-rayon of Murmansk area; Spangenberg, E. P., Leonovitch, V. V., Birds of the northeastern shores of the White Sea.—F. J. T.

Prigogine, A. 1960. La fauna ornithologique du Massif du Mont Kabobo. An. Mus. Roy. Congo Belge, Sci. Zool., **85:** 1–46.—Birds of the Mount Kabobo area on the west shore of Lake Tanganyika in the former Belgian Congo.

Youngworth, W. G. 1960. The Arctic Towhee along the western border of Iowa: a discussion and summary. Iowa Bird Life, **30:** 51–53.—*Pipilo e. erythophthalmus* is breeding form, but *P. e. arcticus* is a regular migrant and sometimes winters.—E. E.

Ecology and Populations

Boswall, J. 1960. Observations on the use by sea-birds of human feeding activities. Brit. Birds, **53:** 212–215.

Boyd, J. M. 1960. The distribution and numbers of Kittiwakes and Guillemots at St. Kilda. Brit. Birds, **53:** 252–264.

Burton, J. H. II. 1959. Some population mechanics of the American coot. Jour. Wildl. Mgt., **23:** 203–210.—Adult survival rate in E. North America is 43 per cent ± 6 per cent. Birds wintering on the southeast coast cross the upper Mississippi valley. Differential migration by sex and age is suggested.—J. P. R.

Chambers, R. E. and W. M. Sharp. 1958. Movement and dispersal within a population of Ruffed Grouse. Jour. Wildl. Mgt., **22:** 231–239.—Sex and age differences in movements of banded birds in Pennsylvania.—J. P. R.

Gillham, M. E. 1960. Vegetation of tern and gannet colonies in northern New Zealand with a comparative note on colonies in the Bass Strait, Tasmania. Trans. Roy. Soc. N. Z., **88:** 211–234.

Goodwin, D. 1960. Comparative ecology of pigeons in inner London. Brit. Birds, **53:** 201–212.—Observations on food, feeding behavior, competitors for food, nesting, and roosting of the Feral Pigeon *(Columba livia)*, the Woodpigeon *(C. palumbus)*, and the Stock Dove *(C. oenas)*.—F. M.

Graham, S. A. and G. S. Hunt. 1958. A noncyclic Ruffed Grouse population near Ann Arbor, Michigan. Jour. Wildl. Mgt., **22:** 427–432.—A 30-year study on 100 acres of swampland.—J. P. R.

Novikov, G. A. 1960. Geograficheskaya izmenchivostj plotnosti naseleniya lesnikh ptitz v evropeyskoy chasti SSSR i sopredeljnikh stran. (Geographical variation in the density of forest birds in the European part of the USSR and adjacent countries.) Zool. Zhurnal, **39:** 433–447.—Field studies and literature data suggest that forest bird densities show a gradual N–S increase, and a less regular E–W increase. Marked yearly and seasonal fluctuations are shown. Factors such as age and composition of forest stands, cultivation, edge effect, etc. influence density. Lowest density has been found in pine woods among the coniferous, and in pure beech stands among the deciduous forest types. Highest densities (up to 42 pairs/hectare) occurred in pure and mixed oak stands (oak-hornbeam, oak-lime, etc.) of the woodland belt and (up to 31 pairs/hectare) in plantations and shelterbelts of the same area. Pine woods apparently did not show density variation throughout eastern Europe.—F. J. T.

Owen, D. F. 1960. The nesting success of the heron, *Ardea cinerea*, in relation to the availability of food. Proc. Zool. Soc. Lond., **133:** 597–617.—Food studied

in England; over six years the average clutch size did not vary, but in years of food shortage last-hatched nestling died; percentage of survival higher in smaller broods.—E. E.

Sherwood, G. A. 1960. The Whistling Swan in the west with particular reference to Great Salt Lake valley, Utah. Condor, **62:** 370–377.—Population fluctuations, food, mortality, advisability of allowing hunting are discussed.—R. E. P.

General Biology

Anderson, A. H. and A. Anderson. 1960. Life history of the Cactus Wren. Part III: The nesting cycle. Condor, **62:** 351–369.—Clutch size, hatching, fledgling success, incubation behavior, nestling and feeding behavior are described. Only female incubates; function of "extra" nests is discussed.—R. E. P.

Atwater, M. G. 1959. A study of renesting in Canada geese in Montana. Jour. Wildl. Mgt., **23:** 91–97.—Two of 12 females renested when their eggs were removed.—J. P. R.

Beebe, F. L. 1960. The marine peregrines of the northwest Pacific coast. Condor, **62:** 145–189.—Taxonomic, life history, and ecological data on the populations of the coastal islands based on 10 years of field work and collecting. Abundant prey in the form of two species of nesting petrels and two alcids permits high reproductive success and unusually dense populations.—R. E. P.

Carrick, R., K. Keith, and A. M. Gwynn. 1960. Fact and fiction on the breeding of the wandering albatross. Nature, **188:** 112–114.—A short but pointed review of the ornithological mythology that has permeated the writings on the wandering albatross, with a plea to supplant this speculation with some of the modern facts known about this bird.—H. C. S.

Chamberlain, J. L. 1959. Gulf coast marsh vegetation as food of wintering waterfowl. Jour. Wildl. Mgt., **23:** 97–102.—An analysis of 1,251 gizzards from 17 species of ducks and geese.—J. P. R.

Crispens, C. G. Jr., I. O. Buss, and C. F. Yocom. 1960. Food habits of the California Quail in eastern Washington. Condor, **62:** 473–477.

Dzubin, A. 1959. Growth and plumage development of wild-trapped juvenile Canvasback *(Aythya valisneria)*. Jour. Wildl. Mgt., **23:** 279–290.—Data from 122 known age birds in southern Manitoba.—J. P. R.

Miller, A. H. 1960. The Slaty Spinetail. Condor, **62:** 413.

Nolan, V. Jr. 1960. Breeding behavior of the Bell Vireo in southern Indiana. Condor, **62:** 225–244.—Life history information based on observations of banded birds at the fringe of the species' range.—R. E. P.

Sage, B. L. 1960. Some notes on the Rufous Warbler. Brit. Birds, **53:** 265–271. —Taxonomy, habitat, nest and eggs, postfledging period, food and feeding methods, and aggressive display of *Erythropygia galactotes familiaris* in Iraq.—F. M.

Selander, R. K. and D. R. Giller. 1950. First-year plumages of the Brown-headed Cowbird and Redwinged Blackbird. Condor, **62:** 202–214.—Occurrence and significance of juvenile feathers retained in first-year plumage.—R. E. P.

Williams, G. R. 1960. The Takahe (*Notornis mantelli* Owen, 1948): a general survey. Trans. Roy. Soc. N. Z., **88:** 235–258.—A full account of all that is known, including much new data on behavior, of a bird that until rediscovered in 1948 was believed to be extinct.—E. E.

Management and Conservation

Barker, R. J. 1958. Notes on some ecological effects of DDT sprayed on elms. Jour. Wildl. Mgt., **22**: 269–274.—DDT was accumulated by earthworms and produced a lethal effect on robins nearly one year later.—J. P. R.

Clawson, S. G. and M. F. Baker. 1959. Immediate effects of dieldrin and heptachlor on Bobwhites. Jour. Wildl. Mgt., **23**: 215–219.—Nearly all resident quail disappeared shortly after treatment of an area with slightly less than two lbs. per acre of these insecticides.—J. P. R.

Decker, E. 1959. A 4-year study of Wood Ducks on a Pennsylvania marsh. Jour. Wildl. Mgt., **23**: 310–315.—An abrupt decline in nest-box usage is attributed to heavy hunting pressure, species vulnerability to gunning, and lack of refuges. —J. P. R.

Fichter, E. 1959. Mourning Dove production in four Idaho orchards and some possible implications. Jour. Wildl. Mgt., **23**: 438–447.

Foote, L. E., H. S. Peters, and A. L. Finkner. 1958. Design tests for Mourning Dove call-count sampling in seven southeastern states. Jour. Wildl. Mgt., **22**: 402–408.—Compares presently used routes with randomly selected routes. Suggests revision of current sampling methods.—J. P. R.

Geis, A. D. 1959. Annual and shooting mortality estimates for the Canvasback. Jour. Wildl. Mgt., **23**: 253–261.—The second report on Canvasback population dynamics based on Fish and Wildlife Service survey and banding data (see Stewart *et al.*, below). Mortality of immatures was 77 per cent and of adults 35–50 per cent. Immatures and adult females had higher mortality rates and were shot earlier in the season than adult males. Both season length and daily bag limits affect the hunting kill.—J. P. R.

Hanson, W. C. and R. L. Browning. 1959. Nesting studies of Canada geese on the Hanford Reservation, 1953–56. Jour. Wildl. Mgt., **23**: 129–137.—Population density, nesting habits (1,032 nests), and productivity in an area exposed to low-level, radioactive contamination. No adverse effects from radiation were noted. —J. P. R.

Marsden, H. M. and T. S. Baskett. 1958. Annual mortality in a banded Bobwhite population. Jour. Wildl. Mgt., **22**: 414–419.—Seven years' banding data on a Missouri refuge population show that annual mortality does not differ from that of hunted populations.—J. P. R.

Peters, S. S. 1958. Food habits of the Newfoundland Willow Ptarmigan. Jour. Wildl. Mgt., **22**: 384–394.—Three hundred crops and 500 droppings examined. —J. P. R.

Schultz, V. and S. H. Brooks. 1958. Some statistical aspects of the relationship of quail density to farm composition. Jour. Wildl. Mgt., **22**: 283–291.—A discussion of problems encountered in sampling and analysis of samples.—J. P. R.

Scott, T. G., Y. L. Willis, and J. A. Ellis. 1959. Some effects of a field application of dieldrin on wildlife. Jour. Wildl. Mgt., **23**: 409–427.—Some species of birds and mammals were virtually wiped out after treatment with three lbs. per acre. Recommendations for reducing wildlife losses are suggested.—J. P. R.

Stewart, R. E., A. D. Geis, and C. D. Evans. 1958. Distribution of populations and hunting kill of the Canvasback. Jour. Wildl. Mgt., **22**: 333–370.—Distribution and size of breeding and wintering populations and migration routes are shown. Hunting kill is related to harvest areas and breeding ground sources. Half the continental population winters in Chesapeake Bay. Seventy-five per

cent of the hunting kill is in the U.S. Production from Saskatchewan is most important in the hunting kill. This paper makes use of the breeding ground, wintering ground, and hunter-kill surveys and banding data collected by the U.S. Fish and Wildlife Service. Limitations of the data and assumptions made in using it are discussed in a valuable appendix.—J. P. R.

Tester, J. R. and L. Olson. 1959. Experimental starvation of pheasants. Jour. Wildl. Mgt., **23:** 304–309.—Pheasants survived at least two weeks without food in midwinter in Minnesota.—J. P. R.

Weller, M. W. and P. Ward. 1959. Migration and mortality of hand-reared Redheads *(Aythya americana)*. Jour. Wildl. Mgt., **23:** 427–433.—Hand-reared Redheads migrate later and have higher mortality than wild Redheads. Populations were not increased by releasing hand-reared birds in Michigan and South Dakota.—J. P. R.

Wilson, H. L. and J. Lewis. 1959. Establishment and spread of the wild turkey in southwestern Michigan. Jour. Wildl. Mgt., **23:** 210–215.—Turkeys released in 1954 are successfully established and now inhabit 233 square miles, nearly all the favorable range.—J. P. R.

Winner, R. W. 1959. Field-feeding periodicity of Black and Mallard ducks. Jour. Wildl. Mgt., **23:** 197–202.—Afternoon flights occurred earlier as population size and/or percentage of Mallards increased.—J. P. R.

Migration and Orientation

Cramp, S., A. Pettet, and J. T. R. Sharrock. 1960. The irruption of tits in autumn 1957. Brit. Birds, **53:** 49–77, 99–117, 176–192.—An important compilation and analysis of records providing the first detailed evidence that the Blue Tit *(Parus caeruleus)* and the Great Tit *(P. major)* are true irruptive species in N.W. Europe. In the fall of 1957 an influx of these two species, and to a much lesser extent of the Coal Tit *(P. ater)*, occurred on the east and south coasts of England. There was a movement to the north and west across England, involving British Blue and Great Tits, which are normally very sedentary. On the continent, movements to the southwest and west occurred from central Europe, through Switzerland to S. France and N. Italy. It is suggested that the irruption was due to high numbers surviving the mild winter of 1956–57. It may have been caused by a behavior response to high numbers before an actual food shortage occurred. Between October and December there was a marked increase in the opening of milk bottles and in paper tearing by tits; the significance of these activities is discussed. Increases in other species *(Carduelis flammea, C. spinus, Dendrocopos major,* and *Garrulus glandarius)*, which are known to be subject to irruptions, were also noted in 1957.—F. M.

Eisenmann, E. 1960. Palearctic waders in eastern North America. Brit. Birds, **53:** 136–140.—A letter commenting on the paper by I. C. T. Nisbet (Brit. Birds, **52:** 205–215). The status of European species on the east coast is reviewed with special attention to the Ruff and Curlew Sandpiper. Nisbet's suggestion that Palearctic species may cross from Africa to South America in autumn and appear in eastern North America the following spring is developed. East-west crossings of the tropical Atlantic would be favored by winds and could account for late summer and autumn records also. The importance of tropical storms in transporting European species is illustrated by records from Barbados.—F. M.

Lack, D. 1960. The height of bird migration. Brit. Birds, **53**: 5–10.—The common Passerine winter visitors to Britain migrate mainly below 5,000 feet. They tend to fly higher in spring than autumn, and higher by night than by day. Occasional individuals were recorded up to 14,000 feet. Very small Passerine night migrants in September were recorded up to 21,000 feet. Waders, mainly Lapwings *(Vanellus vanellus)*, travel at a more constant height than Passerines, nearly all the echoes on any one movement being within 2,000 feet of each other, with a few somewhat higher. Most movements occurred between 3,000 and 6,000 feet, and the highest echo was at 11,000 feet. The problem of how birds determine their altitude is raised. (Author's summary.)

McLean, I. and K. Williamson. 1960. Migrants at station "Juliett" in September 1959. Brit. Birds, **53**: 215–219.—Ten species of land birds as well as migrant terns and phalaropes were seen from a weather ship 400 miles west of Ireland. —F. M.

Physiology

Chandra, P., L. Mendiola, and R. D. Cole. 1960. The effect of prolactin on the xanthine oxidizing activity of pigeon tissues. Endocrin., **66**: 315–316.

Dawson, W. R. and F. C. Evans. 1960. Relation of growth and development to temperature regulation in nestling Vesper Sparrows. Condor, **62**: 329–340.—Measurements of body weight, growth rate, feather development, organ-weight/body-weight ratios, O_2 consumption at various ages and temperatures, and ability to maintain body temperature.—R. E. P.

deRoos, R. 1960. *In vitro* production of corticosteroids by chicken adrenals. Endocrin., **67**: 719–721.—Corticosterone, aldosterone, and possibly cortisol have been identified from Leghorn adrenals.—H. C. S.

Doctor, V. M. 1960. The effect of storage of NaI^{131} solutions upon the thyroid uptake by day-old chicks. Endocrin., **66**: 559–564.

Glees, P. 1960. Effect of cortisone on degenerating nerve fibres in birds. Nature, **187**: 327.

Hoffman, R. A. 1960. Observations on serum and gonad cholesterol in pigeons. Endocrin., **67**: 311–318.—Seasonal cycle with maximum in April and minimum in August; no sexual differences.—H. C. S.

Irving, L. 1960. Nutritional condition of Water Pipits on Arctic nesting grounds. Condor, **62**: 469–472.—Males lose while females gain body fat after arrival on breeding grounds.—R. E. P.

Kobayashi, H. and A. Gorbman. 1960. Radioiodine utilization in the chick. Endocrin., **66**: 795–804.

Kobayashi, H., A. Gorbman, and A. Wolfson. 1960. Thyroidal utilization of radioiodine in the White-throated Sparrow and Weaver Finch. Endocrin., **67**: 153–161.

Laws, D. F. and D. S. Farner. 1960. Prolactin and the photoperiodic testicular response in White-crowned Sparrows. Endocrin., **67**: 279–281.—It was not possible to prevent photoperiodic testicular response by prolactin injections; the role of prolactin in refractoriness is open to question.—H. C. S.

Mancini, R. E., D. Brandes, A. Portela, I. Izquierdo, and P. Kirschbaum. 1960. Autoradiographic and histochemical study of the cock's comb in normal and hormonally treated birds. Endocrin., **67**: 430–440.

Moscona, M. H. and D. A. Karnofsky. 1960. Cortisone induced modifications in the development of the chick embryo. Endocrin., **66:** 533–549.—The susceptibility of various organs in the chick embryo to cortisone is specific and varies with their stage of development.—H. C. S.

Munsick, R. A., W. H. Sawyer, and H. B. Van Dyke. 1960. Avian neurohypophyseal hormones: pharmacological properties and tentative identification. Endocrin., **66:** 860–871.—Oxytocin and arginine vasotocin may be neurohypophyseal hormones in the chicken.—H. C. S.

Nalbandov, A. V. 1959. Neuroendocrine reflex mechanisms: bird ovulation. *In* Gorbman, A. (ed.), *Comparative Endocrinology*, pp. 161–173.—Discusses evidence for a continuous, steady release of an FSH–LH complex from the pituitary, which is inhibited by the passage of an ovulated follicle through the upper oviduct. The complex stimulates the follicles to grow; the largest, most affected because of its greater circulation, grows most and ovulates, allowing others to move up one size as a result of the increased stimulating complex then available to them.—R. E. P.

Nalbandov, A. V. 1959. Role of sex hormones in the secretory function of the avian oviduct. *In* Gorbman, A. (ed.), *Comparative Endocrinology*, pp. 524–532.—Estrogen with androgen or progesterone is needed for full development and secretion of oviduct of immature chicken. No known pituitary or steriod hormones tested would increase carbonic anhydrase in uterus although hypophysectomy reduced it.—R. E. P.

Newcomer, W. S. and P. A. Barrett. 1960. Effects of various analogues of thyroxine on oxygen uptake of cardiac muscle from chicks. Endocrin., **66:** 409–415.

Newcomer, W. S. and J. D. Connally. 1960. The bursa of Fabricius as an indicator of chronic stress in immature chickens. Endocrin., **67:** 264–265.—Bursal regression occurs with certain stress treatments.—H. C. S.

Perek, M. and A. Eilat. 1960. Effect of removal of bursa Fabricii on depletion of adrenal ascorbic acid in ACTH-treated chicks. Endocrin., **66:** 304–305.—A highly significant depletion of ascorbic acid was obtained in bursectomized birds.—H. C. S.

Ralph, C. L. and R. M. Fraps. 1960. Induction of ovulation in the hen by injection of progesterone into the brain. Endocrin., **66:** 269–272.—Premature ovulation was induced when progesterone was injected into the hypothalamus or caudal neostriatum but not when injected into other parts of the forebrain or in the pituitary.—H. C. S.

Schultz, V. 1959. Vitamin A and Ohio Bobwhite quail during the winter of 1947–48. Jour. Wildl. Mgt., **23:** 322–327.—No lack of vitamin A and no significant difference in amount stored was found in two populations.—J. P. R.

Threadgold, L. T. 1960. A study of the annual cycle of the House Sparrow at various latitudes. Condor, **62:** 190–201.—Comparison of cycles of testis activity of five widely scattered populations.—R. E. P.

Urist, M. R. and N. M. Deutsch. 1960. Osteoporosis in the laying hen. Endocrin., **66:** 377–391.—Selective breeding for commercially advantageous traits has increased stress, leading to disorders of the skeleton.—H. C. S.

Urist, M. R. and N. M. Deutsch. 1960. Effects of cortisone upon blood, adrenal cortex, gonads, and the development of osteoporosis in birds. Endocrin., **66:** 805–818.

Wilson, A. C. and D. S. Farner. 1960. The annual cycle of thyroid activity in White-crowned Sparrows of eastern Washington. Condor, **62:** 414–425.—Subjects were mostly sacrificed within 3–10 hours of capture and thyroid activity determined histologically. Thyroid activity was low in summer, intermediate in spring, and high in autumn and winter.—R. E. P.

Witschi, E. 1959. Endocrine basis of reproductive adaptations in birds. *In* Gorbman, A. (ed.), *Comparative Endocrinology*, pp. 517–523.

Wolfson, A. 1959. Ecologic and physiologic factors in the regulation of spring migration and reproductive cycles in birds. *In* Gorbman, A. (ed.), *Comparative Endocrinology*, pp. 38–70.—A review of experiments testing the role of daily light and dark periods in the control of migration and gonad development. —R. E. P.

Taxonomy and Palaeontology

Clancey, P. A. 1960. Miscellaneous taxonomic notes on African birds XV. Durban Mus. Novit. **6:** 13–45.—New subspecies: *Francolinus shelleyi sequestris, Meliërax musicus argentior, Streptopelia capicola abunda, Telophorus quadricolor quartus.* Other species discussed are *Clamator jacobinus* (*serratus* considered a subspecies), *Cuculus poliocephalus, Colius indicus, Erythropygia quadrivirgata, Prionops retzii* and *Zosterops pallida.*—E. E.

Deignan, H. G. 1960. Remarks on the Flower-pecker, *Dicaeum agile* (Tickell). Bull. Brit. Orn. Club, **80:** 142–144.—Questions correctness of Salomonsen's recent treatment.—E. E.

Harrison, C. J. O. 1960. Signal plumage and phylogenetic relationship in some doves. Bull. Brit. Orn. Club, **80:** 134–140.—Many terrestrial genera of doves throughout the world show chestnut on inner webs of primaries, but it may be absent in allied species or even subspecies. The presence of this chestnut may indicate ancestral relationship between the genera; its absence (when otherwise present in the genus) may serve as a specific distinguishing mark.—E. E.

Johnsgard, P. A. 1960. Classification and evolutionary relationships of the sea ducks. Condor, **62:** 426–433.—A re-analysis of the relationships in this group, especially of the behavioral contributions to their systematics.—R. E. P.

Lanyon, W. E. 1960. The Middle American populations of the Crested Flycatcher *Myiarchus tyrannulus.* Condor, **62:** 341–350.—Analysis of morphology, calls, and ecological distribution of four subspecies occurring in the area. All populations have the same basic vocal repertoire, and the author suggests that vocal characters are important in species discrimination.—R. E. P.

Salomonsen, F. 1960. Notes on Flowerpeckers (Aves, Dicaeidae). 3. The species group *Dicaeum concolor* and the superspecies *Dicaeum erythrothorax.* Amer. Mus. Novitates, **2016:** 36 pp.—Four rather than the usual three races of the Philippine *D. hypoleucum* are admitted. *D. erythrorhynchos* (2 races) and *D. concolor* (7 races) are sibling species. *D. davao* may be specifically distinct from *D. pygmaeum.* The superspecies *D. erythrothorax,* including the species *nehrkorni, vulneratum, erythrothorax, pectorale* (including *geelvinkianum*), *eximium* and *aeneum,* is reviewed. *D. aeneum malaitae* is named as new from Malaita, Solomon Is. *D. tristrami* is an aberrant offshoot of this superspecies. —K. C. P.

Singh, R. S. 1960. A new bird to science found from Abary River. *Sporophila hypochroma rothi* Roth's Chestnut-rumped Seed-eater. *The Daily Argosy,* Oct.

25, 1960, p. 6. Georgetown, Demarara, British Guiana.—New subsp. from British Guiana formally described in an ordinary daily newspaper—a most undesirable and unnecessary practice.—E. E.

Traylor, M. A. 1960. Genera *Corythornis, Ipsidina* and *Myioceyx*. Bull. Brit. Orn. Club, **80:** 144–146.—Generic rearrangement of certain Old World tropical kingfishers.—E. E.

Vaurie, C. 1960. Systematic notes on Palearctic birds. No. 42. Strigidae: the genus *Athene*. Amer. Mus. Novitates, **2015:** 21 pp.—The first complete review of the Little Owl *(A. noctua)* throughout its range, with 13 races recognized. One race of *A. brama* reaches the Palearctic; this population was described by Koelz as *A. b. albida*, but is not separable from *A. b. indica*.—K. C. P.

Vaurie, C. 1960. Systematic notes on Palearctic birds. No. 43. Strigidae: the genera *Otus, Aegolius, Ninox* and *Tyto*. Amer. Mus. Novitates, **2021:** 19 pp.—Evidence is overwhelming that *Otus scops* and *O. brucei* are two good species in spite of Meinertzhagen's opinion to the contrary. Two isolated groups of races of *O. scops* are Palearctic; the western *(scops)* group is reviewed briefly, with seven races admitted. *O. brucei* is monotypic. One population of the African *O. leucotis* reaches the Palearctic in the southern Sahara, and may prove subspecifically separable from the Sudanese *margarethae*. Only five of nine proposed races of *A. funereus* are admitted, including the American *richardsoni*. The confused nomenclature of *Ninox scutulata* is reviewed, with three races considered valid. Peters is followed in admitting nine Palearctic races of the Barn Owl; Vaurie does not discuss the family status of *Tyto*, including it with Strigidae without comment.—K. C. P.

White, C. M. N. 1960. Further notes on African warblers. Bull. Brit. Orn. Club, **80:** 147–152.—Subsp. nov.: *Camaroptera brachyura intercalata* south of Mwinilunga, Northern Rhodesia; *Eremomela scotops extrema*, Lungwevungu River, Northern Rhodesia. Other genera and species discussed.—E. E.

Miscellaneous

Friedmann, H. 1960. Changing environment of zoological research. Science, **131:** 590–593.—Support of research by foundations and by the federal government has greatly increased available funds, but has introduced undesirable pressure to work against a deadline. There is an unfortunate tendency to emphasize the project rather than the individual scientist when considering grants. Modern transportation methods make it possible for zoologists to do field work conveniently in previously almost inaccessible areas; new species may thus be available for experimental studies. There is an increasing tendency toward cooperation among specialists in various branches of zoology.—K. C. P.

NOTES AND NEWS

The Josselyn Van Tyne Memorial Fund will have a sum of $300 available for research awards at the end of the fiscal year, 31 July 1961. Any student of birds is invited to apply for part or all of this amount.

Ten duplicate copies of applications are desired for distribution to members of the Research Committee, who will determine how the funds will be allotted. The application should give a full description of the proposed research, the type of help required (equipment, travel, assistance, etc.), the amount of money desired, and the background and training of the applicant. With young men or women just starting their careers, a supporting letter from one or more recognized ornithologists would be helpful.

Applications should be submitted not later than 1 June 1961 to S. C. Kendeigh, Chairman, Vivarium Building, University of Illinois, Wright and Healey Sts., Champaign, Illinois.

As a result of a generous bequest from Elsie Binger Naumburg, who, with her late husband, Walter W. Naumburg, founded the Frank M. Chapman Memorial Fund, it is now possible to expand the Fund's program. In addition to cash grants in support of research, ornithological fellowships with a tenure of one year will be awarded. Applicants need not be residents of the United States. It is expected that recipients will carry out research at the American Museum of Natural History, though in exceptional circumstances they might do so at one of the Museum's Field Stations or elsewhere. Grants will ordinarily be made in March and October, and applications should be in hand by the first of these months. They should outline the proposed research, the applicant's qualifications, provide a budget when necessary, and, for graduate students, include one or two supporting letters. Nonexpendable equipment will, at the discretion of the Memorial Fund Committee, remain the property of the Museum. If specimens are collected, it is expected that all or some of them will revert to the Museum. A copy of any published result of research supported by the Chapman Fund should be sent to the Chairman, and will, it is hoped, give credit for the aid so received. Applications for fellowships or for grants in support of research should be sent to the Chairman, Frank M. Chapman Memorial Fund Committee, American Museum of Natural History, Central Park West, New York 24, New York.

During the spring of 1960 Professor Ernst Mayr made a survey of graduate work in American colleges and universities in which birds were being used as subject matter for theses. Replies to his questionnaires were received from 67 departments of zoology and biology and from 25 departments of wildlife management. Among these departments 43 reported graduate students working for a higher degree, a total of 162 graduate students being reported. These data serve as an interesting indication of the extent to which birds are used for research for theses in this country.—EDITOR

The first triennial award of the Gill Memorial Medal of the South African Ornithological Society for contributions to ornithology south of the Zambezi has been made to Dr. J. M. Winterbottom, Hon. Secretary of the Society since 1951 and Director of the Percy Fitzpatrick Institute of African Ornithology.

The ornithologists of the Soviet Union held in 1956 their first congress attended by more than 350 ornithologists and foreign visitors. The proceedings of this congress, containing 48 contributed papers, has now been published (*Proceedings of the First All-Union Ornithological Conference*, Leningrad, Moscow 1960,—in Russian, with English table of contents). Distribution, migration, habitat, and food ecology are the dominant theses. It is a pleasure to see so much activity, and one would wish that our Russian colleagues and we could have closer contacts with each other.—ERNST MAYR.

Dr. Oliver L. Austin, Jr., Curator of Birds, The Florida State Museum, has been appointed Chairman of the Bent *Life Histories of North American Birds* Committee by the Nuttall Ornithological Club.

Alarmed by persistent reports of a downward trend in the population of Bald Eagles, the National Audubon Society has launched a study aimed at determining the status of the species. This project is designed to cover at least five years and to gather data from all parts of North America. The study will consist of two parts: first, an inventory based on the number of active nests located, and second, an investigation of various aspects of eagle biology. Information is urgently needed on the location of active eagle nests and also on wintering concentrations of eagles. If you have information on these or any other facets of eagle biology, please communicate with: Alexander Sprunt, IV, Box 231, Tavernier, Florida.

The American Ornithologists' Union will meet in 1961 at Washington, D.C., with The United States National Museum and the Bureau of Sport Fisheries and Wildlife, U.S. Fish and Wildlife Service, as host organizations, and the Audubon Naturalist Society of the Central Atlantic States a sponsoring organization. The scientific sessions will be held Wednesday, Thursday, and Friday, 18–20 October, in the auditorium of the U.S. National Museum. The business sessions will be held on Tuesday, 17 October, at places to be announced later. Field trips are planned for Saturday, 21 October. The Annual Banquet will be held in the ballroom of the Hotel Willard on Friday evening, 20 October.

Applications for a position on the program should be submitted not later than 1 September. A formal "call for papers" will be circulated well before the deadline.

Convention headquarters will be the Willard Hotel, Pennsylvania Avenue and Fourteenth Street, Washington 4, D.C., situated in the heart of down-town Washington and within walking distance of the National Museum.

This will be the fourteenth Washington meeting and the first since 1938.

Through the generosity of the Marcia Brady Tucker Foundation, Inc., we are again in a position to award funds to assist promising young ornithologists to attend the annual meeting of the Union. The amount granted will depend upon distance to be travelled and personal need. Any member may nominate candidates. It is not required that awardees present papers at the meeting, but since some may wish to apply for a position on the program, it is important that nominations be in hand *not later than* 1 August 1961.

Please send to the Secretary (H. G. Deignan, U.S. National Museum, Washington 25, D.C.) the following information: (1) name, age, and address of the nominee; (2) education and experience of the nominee; (3) a statement by the sponsor on the capabilities, special interest, and financial need of the nominee.

CORRESPONDENCE

Dear Dr. Farner:

I wish to announce to the members of the A.O.U. that on June 1, 1961, I shall assume directorship of the Robert Moore Laboratory of Zoology at Occidental College, Los Angeles, California.

In the past, work on the specimens in the Moore Laboratory has been in large part conducted by biologists at Occidental College and by those workers at other institutions in California close enough to allow personal visits to Occidental's campus.

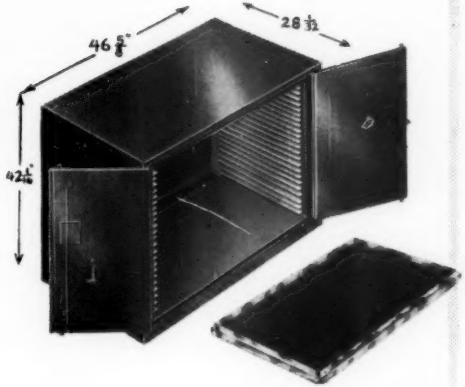
Beginning next June, the Moore Laboratory will undertake a policy designed to encourage ornithologists everywhere to utilize as completely as they might wish the facilities and specimens in the Moore collections. Workers will be welcome to visit the Laboratory as in the past and may borrow specimens contained therein under normal rules of shipment, care, and return similar to rules enforced at other institutions. In addition, an attempt will be made to ascertain facts about specimens in the collection for workers, when only this is necessary.

Finally, I wish to extend two invitations. First, those workers who may need to use the Moore Laboratory before next June may write to me in care of the Department of Zoology, University of California, Los Angeles 24, California. (Time that I may devote until June, 1961, to the Laboratory and to requests is limited, but if needs are urgent I shall make every effort to fulfill them.) Second, I solicit the advice and suggestions from specialists in particular groups of birds who may be aware of specimens in the Moore Laboratory that require careful reëxamination and to workers whose familiarity with the Moore collections may be valuable in increasing the usefulness of the Laboratory.

On behalf of the Department of Biology at Occidental College and myself, I urge ornithologists to avail themselves of the Moore Laboratory facilities and specimens so that it may further realize its potential value to biology.

Sincerely,

JOHN WILLIAM HARDY



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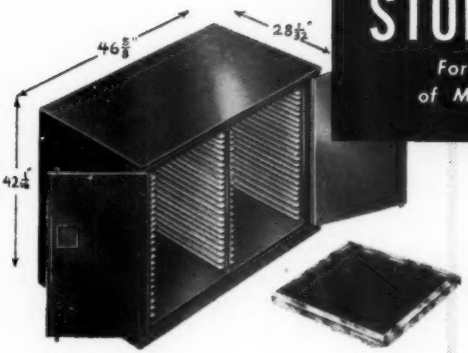

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All articles and notes submitted for publication and all books and publications intended for review should be sent to the Editor:

DONALD S. FARNER, *Department of Zoology, Washington State University, Pullman, Washington.*

All persons interested in ornithology are invited to join the American Ornithologists' Union. Application may be made to the Treasurer; dues for Members are $5.00 per year. 'The Auk' is sent without charge to all classes of members not in arrears for dues.

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